Model Engineer

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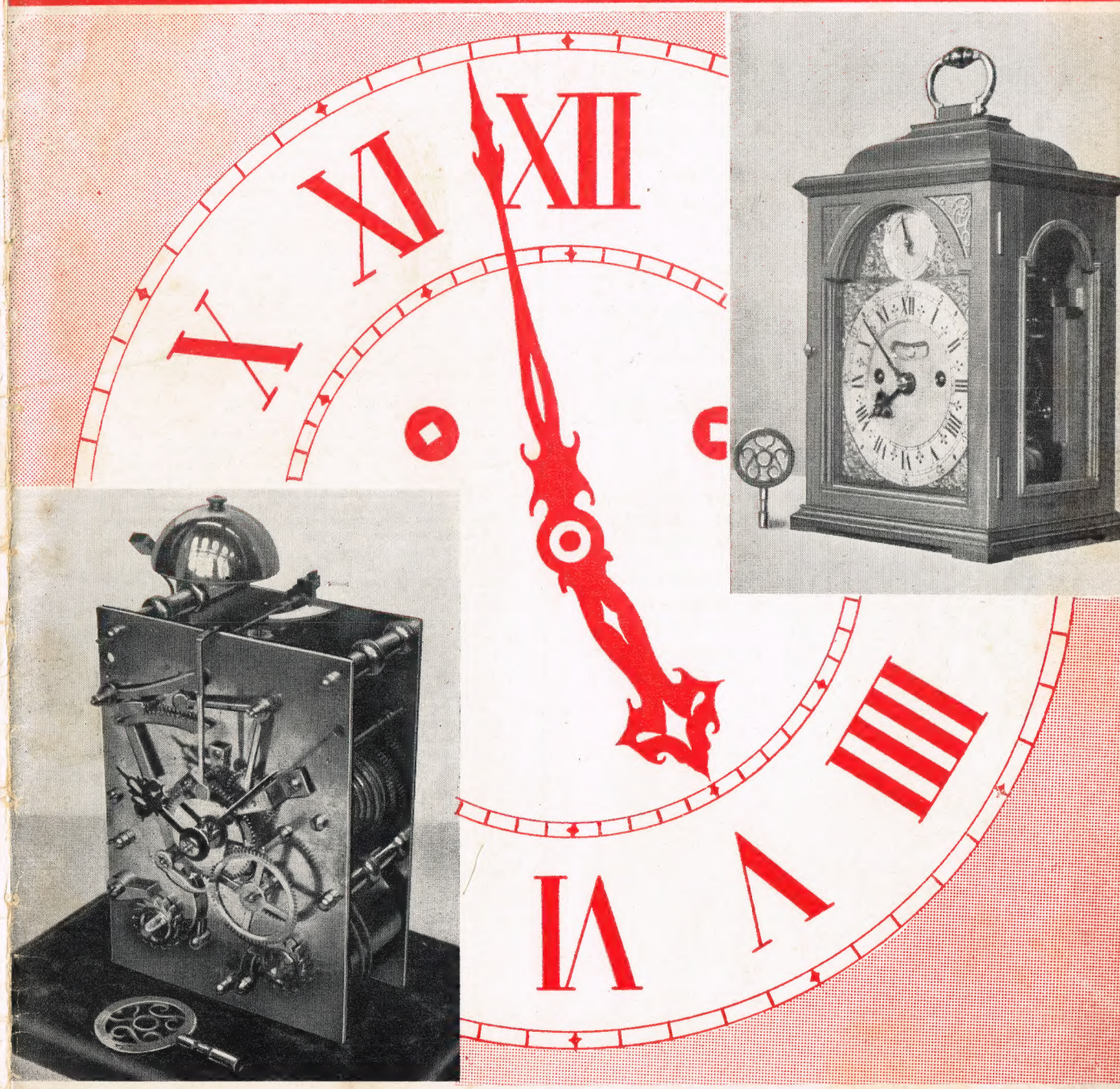

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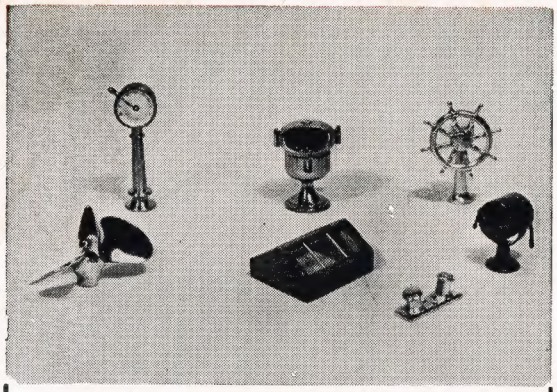

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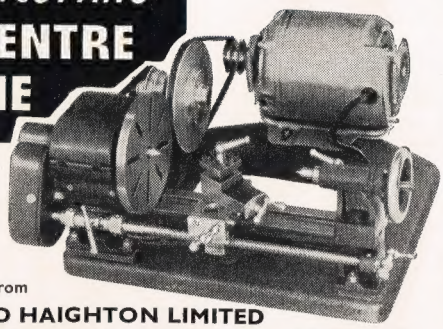

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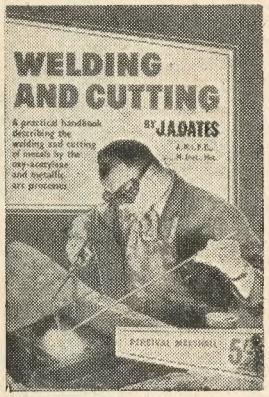

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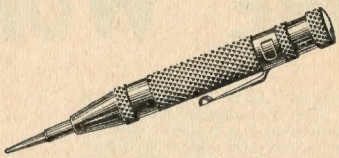

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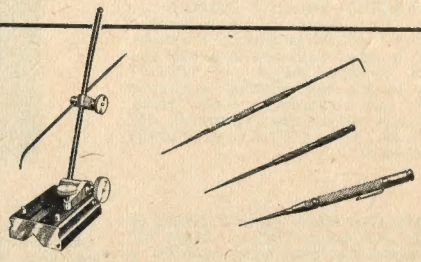

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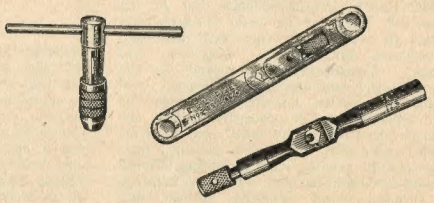

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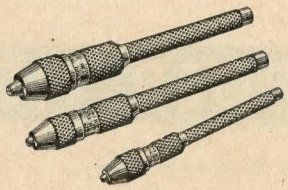

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IN THIS ISSUE

803 Smoke rings
805 Bracket clock
811 Beginner's workshop
812 Lathe you can build
814 Carburettor adjustment
815 Speedboat competition
818 Jimpy
820 Myrmidon—6
823 L.B.S.C.
826 Tailstock for Drummond
828 Expert's workshop
830 Ruston 52266
831 Postbag
834 Readers' queries
835 Jason's notes
836 Club news
837 Photographic competition

NEXT WEEK

100,000 r.p.m.: A super-speed turbine engine

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Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

AN article in our next issue by Mr Kyrle Willans will remind readers that in the early days of electric power generation, Willans steam engines made an important contribution to the means available for driving dynamos and alternators. Up to that time, steam engines had mostly been designed to run at relatively low speeds, and when such engines were used it was necessary to make the electrical generators very large for their output.

The advent of the high-speed engine enabled the entire plant to be made much smaller and more compact, but it introduced new problems of design, and orthodox types of engines were not readily adaptable to running at high speeds, due to difficulties in balancing, lubrication, etc.

Several types of Willans engines were designed to cope with these problems, the best known being the "central-valve" type, in which the cylinders were arranged in tandem, with piston valves working concentrically inside the pistons. The working parts were totally enclosed and lubricated under pressure, making it possible to run them safely at speeds far in excess of the orthodox type, while thermal efficiency was improved by the internal valve arrangement.

Mr Kyrle Willans is the son of the designer of the original Willans engines, and has himself spent a lifetime in the study of steam engine and plant design.

Million passengers

THE popularity of the 3-ft gauge, exclusively steam-operated, Isle of Man Railway with visitors is shown by the fact that more than 1,000,000 passengers used the line last year. The weekly runabout ticket was probably a major factor in increasing passenger journeys by 17,000 and passenger receipts by £922 compared with 1955.

However, this narrow-gauge system is seriously affected by wage awards—and because the railway depends substantially on a few weeks of profitable working each year its rising costs can be met only by rigid economy.

High revs !

ONE of the most active members of the St Albans and District Model Engineering Society is Mr R. Mapplebeck, whose article on an experimental steam turbine will appear next week. In previous articles he has described experiments in various aspects of model power boat design, embracing steam and i.c. engines, solid-fuel and oil firing, and radio-control, all of which demonstrate an insatiable appetite for tackling and demolishing technical problems.

There is certainly unlimited scope for this kind of talent in the design and development of small turbines, about which very little practical information is so far available. In a crude and elementary form, turbines are very easy to construct, and will

Smoke rings . . .

run on low steam pressures; but it is quite another matter to produce a turbine which will work efficiently and economically, so as to produce the high performance of which it is theoretically capable.

A few model engineers, however, have had courage enough to carry out serious research on this subject, and it is hoped that their efforts will encourage others to do the same. Mr Mapplebeck's article will be welcomed by many readers who believe in the possibilities of the model steam turbine.

Clock enthusiast

JOHN C. STEVENS, who contributes the article on the eight-day striking bracket clock, has won several awards for his model engineering work.

John C. Stevens

A teacher by profession, he spent several years of his earlier life in the drawing offices of different firms. He never served a workshop apprenticeship but developed his considerable engineering skill by the practical method of trial and error, and from information gleaned from the pages of this magazine over many years.

All his lathe work is done on a small 2½ in. plain Portass which has served him faithfully since the day it was given him 25 years ago.

His first model engineering interest, he tells me, was in steam power boats and in 1937 he won a diploma for a flash-steam launch which he entered at the ME Exhibition in conjunction with a friend.

Then clockmaking claimed his attention and in 1950 he secured another H.C. diploma with some wheel-cutting work; and in 1952 a Hipp-type clock gained a similar award, both, of course, at ME Exhibitions.

But it was last year that Mr Stevens had the biggest thrill of all when his bracket clock was awarded the coveted Championship Cup.

Remote control

WHILE daddy has been enjoying himself with his radio-controlled cabin cruiser junior has had to be content with a wire cable to remotely control his toy motor car.

But the boffins behind the toy industry have now dispensed with the cable, for a new toy car, the Cybercar, now on show at the Foire de Paris (international trade fair), can be controlled by an electric torch. Like daddy's cabin cruiser, there is a toy counterpart, also, that can be guided from port to port by torch control.

Radio-control has now made a big invasion of the toy territory, and one of the stands at the fair will depict an island, in miniature, with helicopters and planes taking off and landing and model ships sailing the sea.

Among the several toy locomotives and model railway installations will be a scale version of the famous French electric locomotive BB 9004 which broke all world's records two years ago with a phenomenal speed of 205 m.p.h.

Numbering diesels

BRITISH RAILWAYS are to adopt a new system of numbering for new main line diesel locomotives and for new and existing standard diesel shunting locomotives.

The present system of numbering, from 1 to 99999 covering steam, diesel and electric locomotives, leaves insufficient scope for allocating consecutive block numbers to all the main line diesels planned under the railway modernisation and re-equipment programme. To have continued with this series would have meant using six-figure numbers commencing at 100000 which would have been cumbersome, costly, and liable to misquotation.

To overcome this it has been decided to adopt a scheme of numbering using the letter D as a prefix and starting with D1. Under this system block numbers are being allocated to the various diesel locomotive power groupings so that a locomotive's number, in addition to identifying it, will also indicate its power range. For example, 1,000-1,250 h.p. locomotives are to be numbered in the D5000-6000 series, and the 800-1,000 h.p. locomotives in the D8000 series.

The first locomotives to be numbered under this new scheme are the 174 main line diesel locomotives now being built under the contracts announced in 1955.

The B.R. standard 350 h.p. diesel shunting locomotives, at present included in the 13000 series, are being re-numbered in the D3000 group. The 200 h.p. diesel shunting locomotives at present numbered in the 11000 series will eventually be included in the D2000 group. It is not intended to re-number the existing eight main line diesel and gas turbine locomotives.

Cover picture

Two views of the bracket clock built by John C. Stevens which won the Championship Cup for General Engineering at the 1956 *Model Engineer Exhibition. Mr Stevens writes of it on pages* 805 *to* 810.

Harnessing the sea

THOUGH engineers always look down from a great height on anyone who suggests getting power from the tides, I have never been convinced that the idea is totally impracticable.

Now I see that a serious attempt is being made to utilise the power of the sea, for in Brittany, in Northern France, work has begun on the installation of a hydro-electric power station at the mouth of the River Rance. The tide at this spot rises 45 ft.

Water will flow into 38 groups of a new type of turbine that can function both ways—by the incoming and outgoing tides.

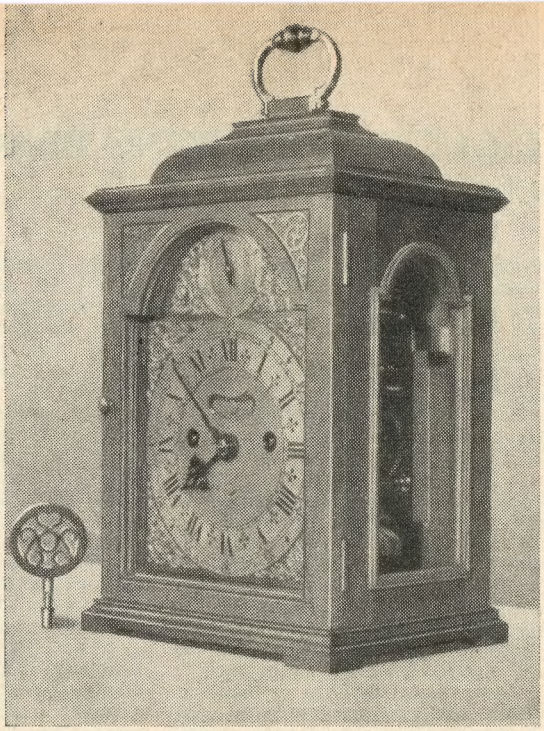
The plant is to operate in conjunction with a normal hydro-electric generating station fed by a reservoir so that when the tidal station is working the other plant is shut down, and vice versa. In this way the supply of electricity, which will be pumped into the French national grid, will remain constant and not limited by the fluctuation of the tides.

It is hoped that the station will go into service between 1962 and 1964 and that the annual production will be about 800 million kWh.

AN EIGHT-DAY STRIKING BRACKET CLOCK

By J. C. STEVENS

This is the clock which secured the Championship Cup (General Engineering) at the 1956 M.E. Exhibition



As horologically minded readers of this journal appear to be growing steadily in numbers —judging from entries in this class at recent exhibitions—it is hoped that these notes on the construction of an eight-day striking clock will stimulate interest still further.

I am particularly attracted by the work of the old clockmakers, who seem to have had an unerring eye both for soundness of mechanical construction and for sheer beauty of design as a whole—witness the many fine lantern, bracket and long-case clocks on view in many of our national museums. Moreover, the work is of a size which can be produced on the smallest of model-engineer lathes, providing that some ingenuity is shown in improvising various simply-made attachments to machine the more awkward parts of the movement.

Although the old-time makers did not generally make the cases for their clocks, I undertook this task and was fortunate enough to be given permission to make fully-dimensioned sketches of an elegant mid-eighteenth century specimen by a well-known maker, from which the case illustrated was eventually made.

Home-grown pearwood was used, cut from the bough of a large tree, which was roughly sawn into short planks and allowed to season for about one year. It was thought that if the pieces were cut roughly to size —making suitable allowances for warping and shrinking, of course— the period of drying out would be greatly reduced. This seemed to be borne out in practice, and the various parts of the case were finally assembled without difficulty.

Fig. 1 shows the front and side elevations of the case with the two glazed doors and sides. In the front elevation only half of the door is shown, revealing the front part of the case through which the dial of the clock is seen. The doors, front and sides were framed up, each of four pieces joined together with the type of joint shown in Fig. 1a *D*. The doors were made $\frac{3}{8}$ in. thick and the side members of $\frac{1}{2}$ in. material, the latter being made about $\frac{1}{2}$ in. longer than is apparent to allow of jointing later into the base and top.

The domed upper part of the case —known for some reason as the basket top—was made by carefully mitring four pieces together, afterwards planing them to a quarter-round section (using a template as a guide) and finishing with fine glass-paper.

A block of pearwood carved to a concave shape fits into the main basket, and carries the brass handle pivoted to a brass block, as illustrated in the sectional drawing, Fig. 1a *B*. Two studs attached to this block pass through a metal plate screwed to the underside of the basket, and the handle assembly is secured by two finger-nuts as shown.

The basket is screwed to the top of the case by eight screws while the sides are tenoned to fit into slots cut in the base and top and are additionally provided with $\frac{1}{2}$ in. square fillets screwed into each corner. In this way the case is completely held together by screws, as well as by glued joints—a wise precaution in view of the considerable weight of the movement.

Fig. 1a *C* represents a plan view of the front of the case with the top piece removed. It will be seen that the front frame is attached to the side members with a tongue and groove joint and also provided with a key or feather of wood in the centre, which fits into a corresponding slot in the top piece.

The moulding around the rear door, side windows and basket is shown enlarged in Fig. 1. This was actually produced with a fly-cutter of suitable shape rotating at a high speed, while strips of wood were slowly pushed into contact with it by means of an improvised miniature saw-table.

The mouldings around the base and top of the case were worked in the solid wood by means of files and an improvised scratch stock—simply a steel screw in a block of wood, using the sharp edge of the head as a cutter. The mouldings were finally finished off with a touch of fine glass-paper.

I made all the case fittings, the handle, hinges, catches, etc. The frets in the arch of the front door are of brass while those in the rear door are of pearwood pinned to pieces of wood shaped to fit into the apertures.

CUTTING THE PINIONS

It is not possible to give full details of the movement in a short article—in fact it is doubtful if any elaborate drawings were ever made by the old craftsmen themselves. I designed the

EIGHT-DAY STRIKING BRACKET CLOCK—continued

layout by making sketches from specimens in various London museums and then laying out the positions of the wheels on paper. Details were designed to fit in as construction proceeded. As a guide to intending constructors, the plates are $4\frac{11}{16}$ in. wide × $6\frac{5}{8}$ in. high, spaced apart a distance of $2\frac{1}{8}$ in. All the wheels are 44 d.p.

I described a method of wheel-cutting (including cutter-making) in the issues of MODEL ENGINEER for 29 January, 5 February and 12 February 1953, and it is proposed here to describe briefly the manner of cutting the pinions and grooving the fusees. Incidentally, pinion-cutting proved the most difficult operation in the construction of the entire clock.

After several fruitless attempts at cutting pinions from silver steel with a rotary cutter—where the cutter merely jammed or lost its edge as soon as it met the steel blank—a lever attachment was made to clamp on to the lathe bed to operate the saddle with slow powerful strokes similar to a shaping machine (Fig. 2).

It was now found possible to cut out the spaces between the pinion leaves with a suitable V-shaped tool clamped to the cross-slide, providing very small cuts were taken. The tops of the leaves were finally rounded off with a small form tool as shown at *B* (Fig. 2).

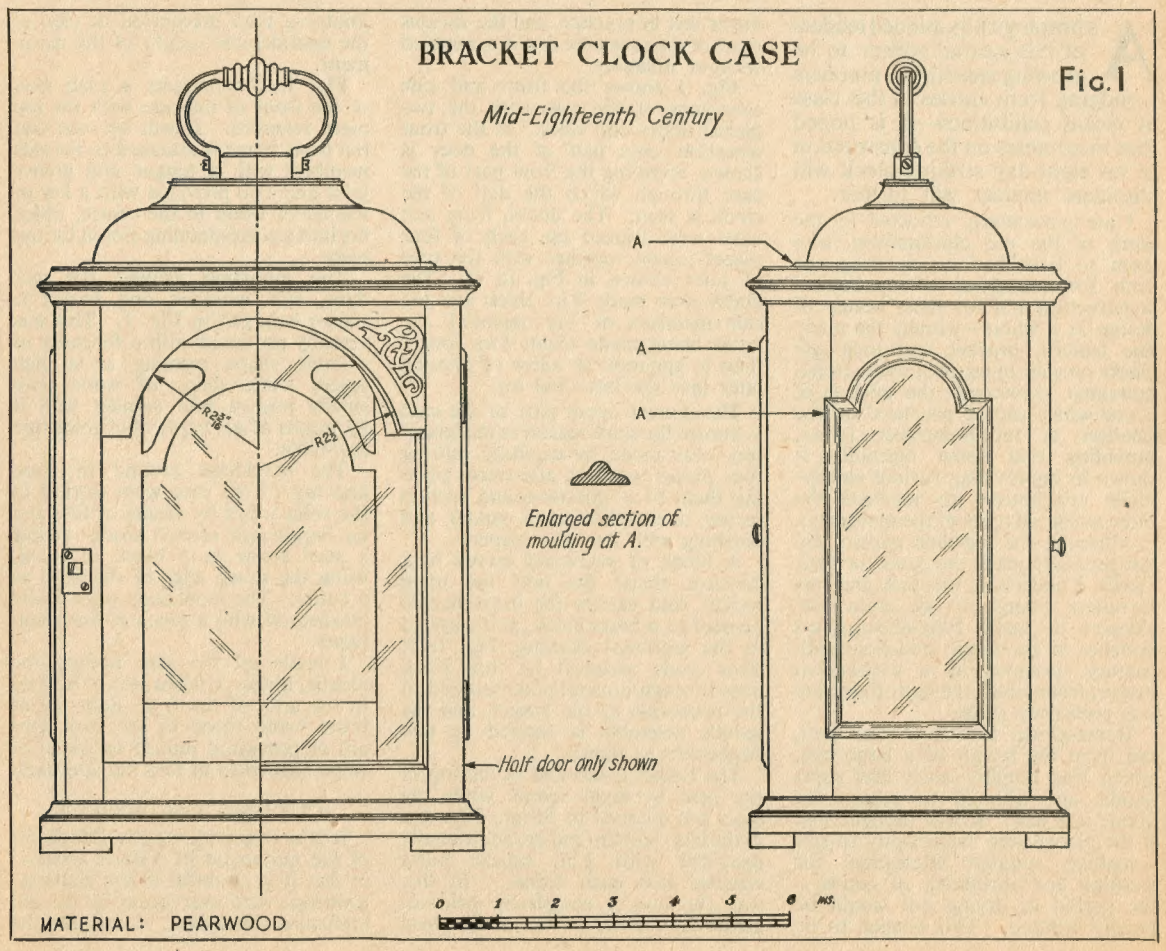
It was discovered that an old flat file provided the best material for the main cutter, which undergoes considerable stress on the return stroke of the saddle; probably some improvement could be made here by hinging the cutter clapper-box fashion.

It will be noticed that a special back centre was made incorporating a stout angle piece, provided with a hardened adjustable screw. This serves as a steady to prevent the blank deflecting outwards during cutting, and proved both necessary and successful.

Of course, the pinion blank, which is mounted between female centres, must be held securely to the faceplate pin, either by using a well-fitting forked carrier or a suitable clip. To ensure maximum rigidity during cutting the blank is only turned down sufficiently to expose the pinion-head and provide clearance for the cutter. The rest of the arbor is reduced to size afterwards.

When the pinion is cut and turned to size—leaving the pivots until later—the arbor is hardened and tempered and then paned true with a light hammer.

This latter operation is the crucial stage when it is only *too* easy to snap the arbor in two. I found from bitter experience that silver steel is still extremely brittle even when tempered to a blue colour (which is normally recommended as the ideal) and



tempering below this seems necessary to avoid disaster. For details of peening, however, it would be better to consult the standard textbooks dealing with practical horology.

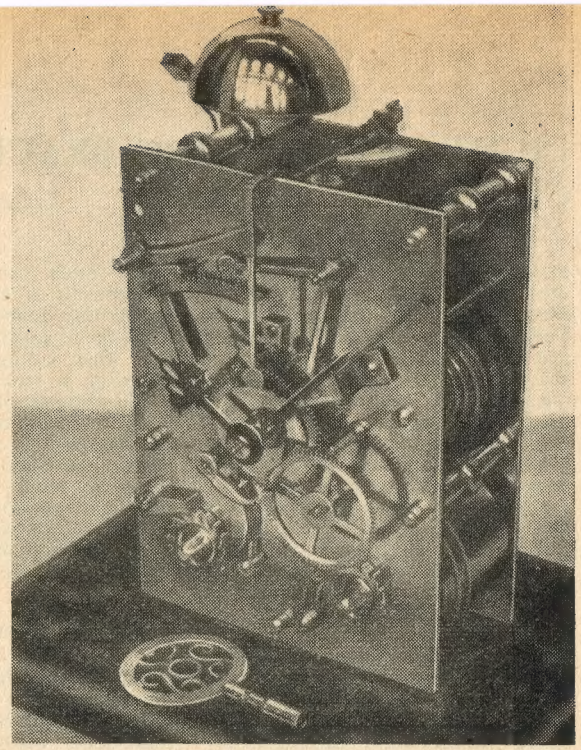
As a final suggestion, it would probably be quite satisfactory to use the pinions in their soft state and thus avoid entirely all these complications. Silver steel is a harder material than the wrought iron used by early clock makers, and I am trying out this experiment in a clock at present under construction.

GROOVING THE FUSEES

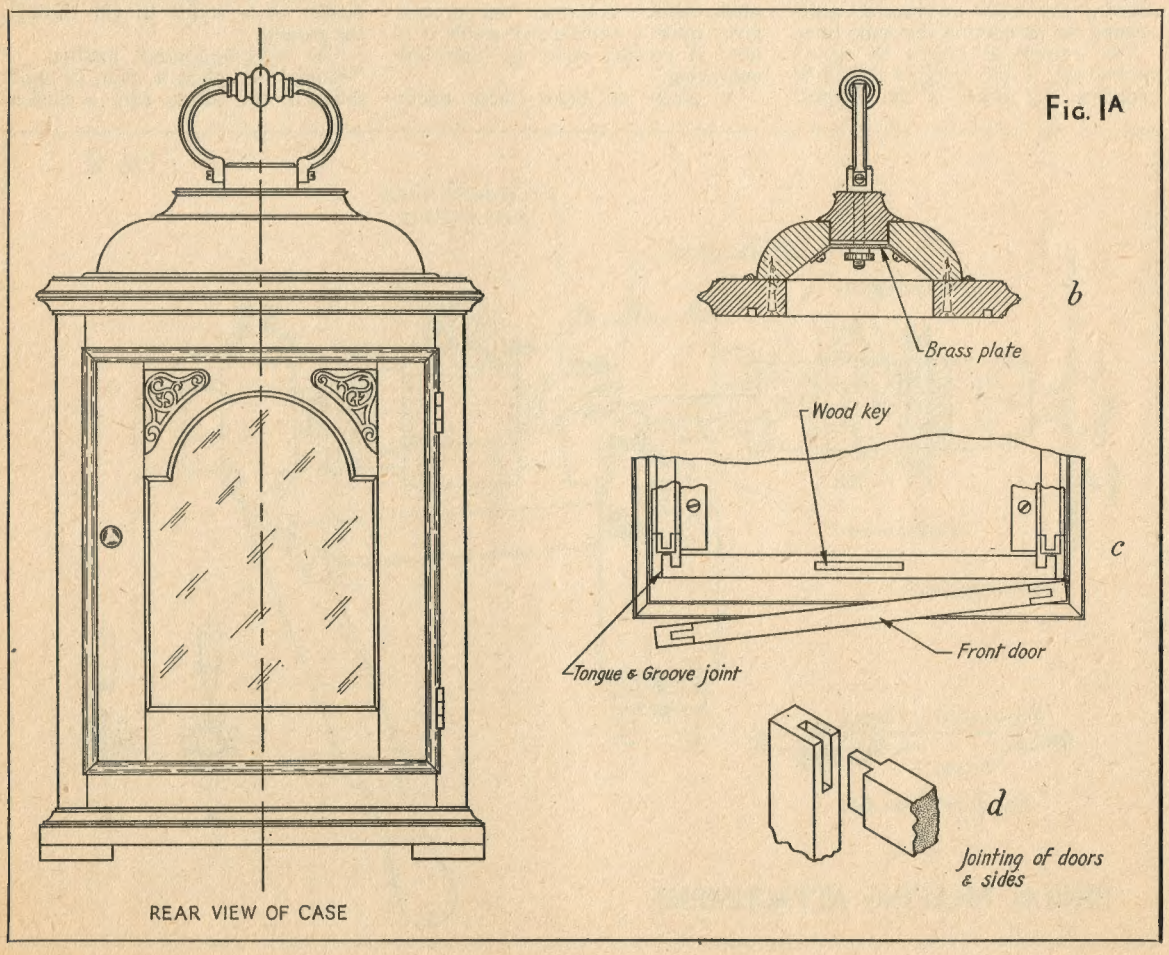
The awkward operation of grooving the fusees was carried out quite successfully by means of the attachment shown in Fig. 3.

The fusee blank, driven onto its silver steel arbor, was turned to shape between lathe centres and the front end of the arbor, turned down and temporarily threaded $\frac{1}{4}$ in. × 40, leaving a true shoulder.

A $\frac{1}{2}$ in. × 12 t.p.i. bolt and two hexagon nuts were purchased from the local ironmonger and the head



Right: Front view of the movement with the dial removed



EIGHT-DAY STRIKING BRACKET CLOCK—continued

of the bolt sawn off. The bolt was then truly mounted in a four-jaw chuck and one end carefully centred, while the other end was truly drilled and tapped $\frac{1}{4}$ in. × 40. A length of heavy mild-steel bar was attached to the nuts by 2 B.A. screws and distance pieces, and a small block of steel with two centre holes in the end faces was firmly attached to the other end as shown. Next, a piece of $\frac{3}{8}$ in. brass bar was cut to the shape shown and furnished with coned pivot screws and locknuts to fit on to the steel block, and the other end drilled and squared to take the cutter which is secured by a setscrew of any convenient size.

It will be obvious that if the fusee arbor is screwed truly into the $\frac{1}{2}$ in. bolt and the whole assembly placed between centres, it is possible to cut a screw-thread on the blank by merely pressing the cutter downwards while turning the mandrel at the same time.

Two important points to ensure success are: *1*, the carriage should be supported by means of the toolpost stud, which can be utilised very conveniently to take the side thrust of the cutting action, and, *2*, the tool must be so positioned in the holder that when cutting on any diameter the edge is never above the centre height of the blank. It is unavoidable, of course, that the tool will alter its relative position to the blank as it follows the contour of the cone, but this is not serious providing that only very light cuts are attempted.

An enlarged view of the cutter is given, showing the "stop" which is formed at the side to limit the depth of cut.

THE CHAPTER-RING AND DIAL-PLATE

The serious difficulty of engraving the chapter-ring was overcome by etching the numerals, minute graduations and ornaments with dilute nitric acid. Although this process gives quite a satisfactory result it is not, of course, equal to high-class engraving.

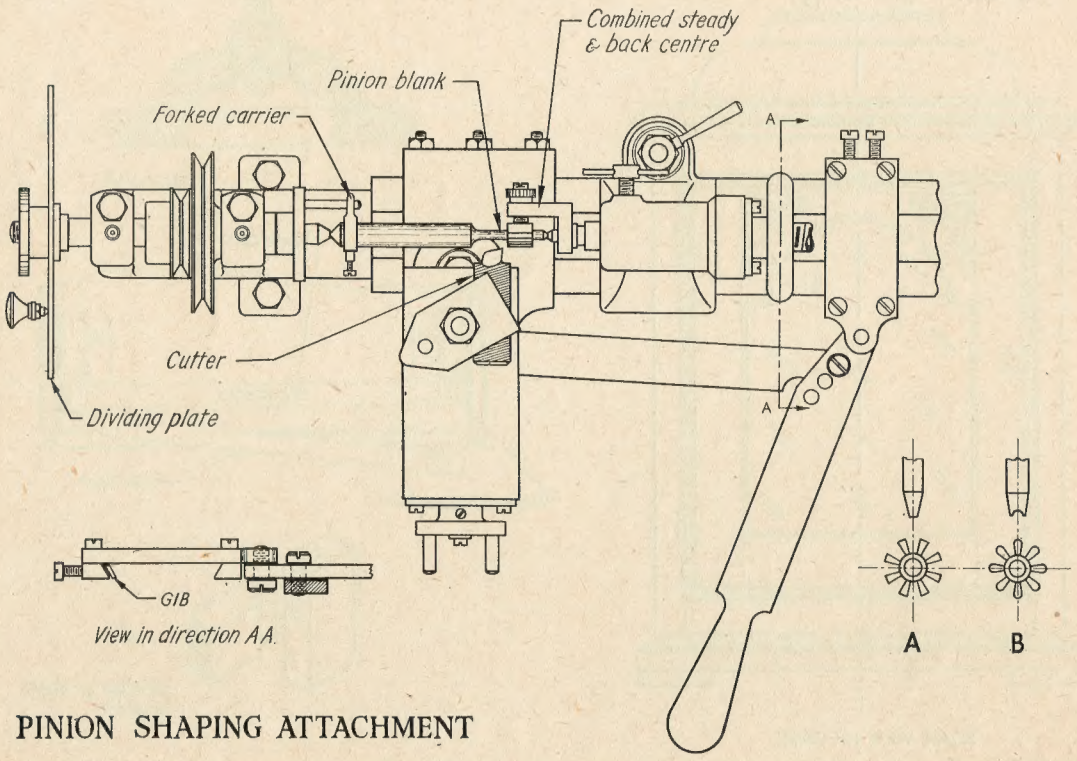
A piece of brass sheet about 3/64 in. thick was sawn out to form a solid disc and the numerals, minute graduations and ornaments heavily marked out with a sharp scriber. The broad strokes of the roman numerals were then cut out with a fret saw and the slots trimmed with suitable files.

The remainder was etched in the following way. A piece of etching-ball was purchased, and after the disc had been thoroughly cleaned with white spirit it was warmed over a gas-ring and the etching-ball applied to the plate. The melted wax was then quickly rolled out with a small photographic roller leaving a fine golden film on the plate. Incidentally, the plate must not be so hot that the wax smokes, but it *must* melt freely on contact.

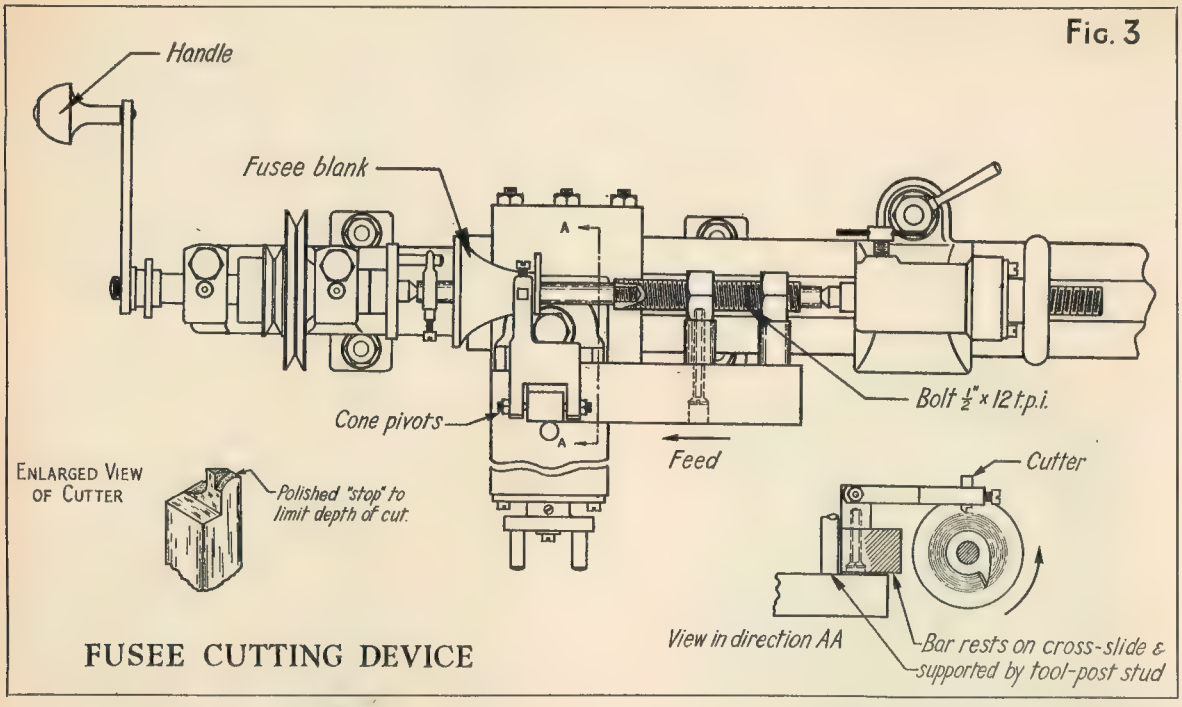
The second stage is to blacken the wax coating by holding the plate over a candle flame, which not only produces a good drawing surface but also increases the strength of the ground. If the marking out has been boldly done it should still be visible through the wax and the design is then gone over again, using a blunt scriber as a stylus to cut through the ground.

The time-honoured method of "biting" the plate is, first, to apply saliva to the design with a chicken

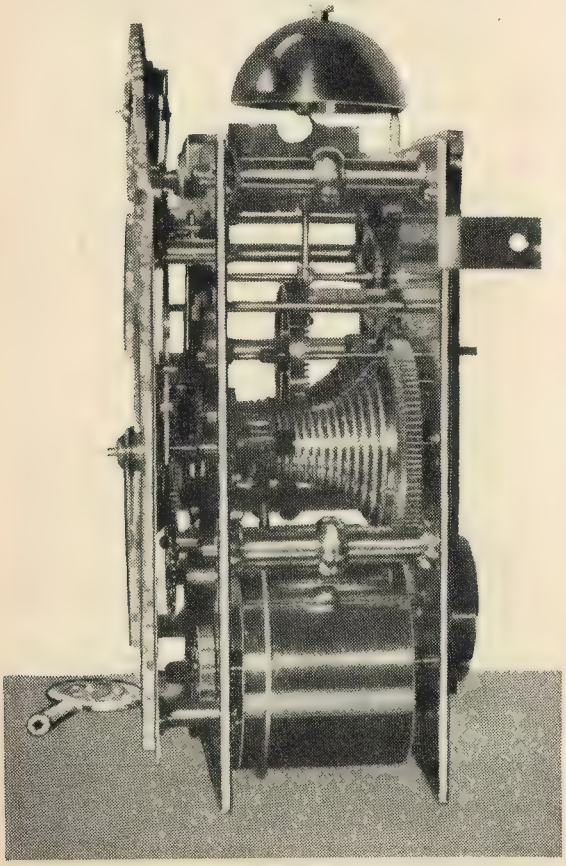
FIG. 2



PINION SHAPING ATTACHMENT



FUSEE CUTTING DEVICE



Side view of the movement

feather, which, after a short time, is washed off with cold water and the plate dried by patting it with strips of clean blotting paper. Next a beaker of dilute nitric-acid is prepared (one part acid to one part water) and a few drops applied to the design with the feather. The acid should flow freely where the saliva has been, forming a pool over the part to be etched, and in following this method the necessity of immersing the whole plate in a bath of acid is avoided.

After a time tiny bubbles should appear in the acid "puddle," indicating that etching is taking place; if nothing occurs a little more acid should be added to the solution and another attempt made. It was found that about 15 to 20 minutes was necessary for the acid to bite to a reasonable depth, which should be somewhere between 1/64 in. and 1/32 in.

It is advisable to experiment on a piece of scrap brass before venturing on the dial itself and one should aim at using as weak a solution as possible, which may be allowed to act on the metal for a longer time. The danger of using a strong solution is that it may cause the ground to collapse and so ruin the design.

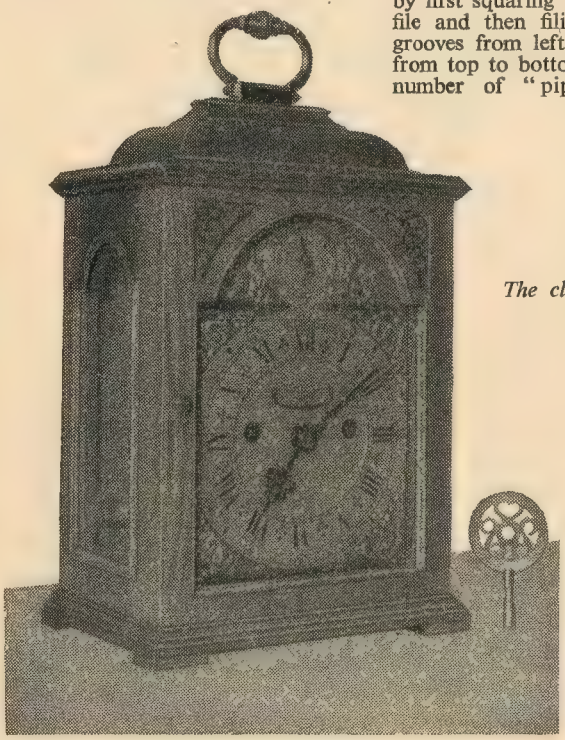
After the disc had been etched the centre part was cut out and the ring laid on an asbestos mat and placed over a gas-ring, being heated just sufficiently to melt the engravers' wax with which the design is filled. The

BRACKET CLOCK

dial was then rubbed down with pumice stone and water until all the surplus wax was removed. A circular grain was given to the ring, which was then silvered and protected with a coating of a silicone wax polish. This seems quite successful and avoids the difficulty of lacquering, which may cause the wax filling to "run."

The centre part of the dial-plate enclosed by the chapter-ring was matted in the following way.

A multiple punch was made from a piece of $\frac{5}{16}$ in. square silver steel by first squaring off one end with a file and then filing a series of V-grooves from left to right and then from top to bottom—thus forming a number of "pips," similar to a knurled surface—after which the business end was hardened and tempered.



The clock—completed and in action

The plate was next laid on a steel block held in the vice and the punch operated by tapping lightly with a hammer. This is a slow and tedious operation and the panel is moved slightly after each tap until the whole plate is evenly dimpled. After a time the metal will stretch and become bowl shaped, but this cannot be avoided and when the matting is finished the plate is annealed and tapped out flat again by means of a *wooden* mallet.

The matting on old clock dials is, as a rule, very beautifully done; the surface is not only very finely pitted but the dimples are also very evenly spaced—in fact, the process is considered to be a lost art. Nevertheless I was able to produce a tolerable result with the expenditure of much time and patience.

As an experiment the small zone enclosed by the calendar ring was matted in a different way. A circle representing the area to be matted was drawn on the plate and a series of closely spaced lines was scored from left to right. This was followed by another series from top to bottom followed by another two series along each diagonal, Union Jack fashion.

If a sharp scriber is used and considerable pressure applied a nice matted texture will result. Moreover, this method does not appear to seriously buckle the plate. It must be admitted, however, that the result does not appear to be quite "right," somehow, and the punch method is to be preferred, which is probably that used by the old clockmakers themselves. ▣

DANE SAILS ATLANTIC SINGLE-HANDED

CAPTAIN Walther Westborg, wiry 38-year-old Danish seaman, has crossed the Atlantic single-handed in a 23 ft lifeboat powered by a Peterborough-made diesel engine.

He has just sailed from Tenerife to Charlotte Amalie, St Thomas—a distance of more than 3,000 miles—in the all-steel *Dana Rescuer*. The crossing took over a month in the tiny lifeboat, weighing only nine tons.

During his epic Atlantic crossing, Wesborg encountered whirlwinds and his side rudders were temporarily out of order after a metal part snapped in a heavy easterly swell in mid-ocean.

He met only two ships during 33 days at sea; they were the *Santa Maria*, of Lisbon, and the tanker *Latirus*, on a journey from Curacao to Gibraltar. They gave him provisions, including tobacco, cognac, bread, fruit and meat.

The boat is fitted with a Perkins L4 four-cylinder diesel engine with a Parsons 2 : 1 reduction gear. It has been rated to give 46 b.h.p. at 1,500 r.p.m. The *Dana Rescuer* has a six knot cruising speed and a maximum range of 4,000 miles.

Captain Westborg reported that the diesel behaved perfectly during the long crossing.

The *Dana Rescuer* was designed by Claus Sorensen, who commanded the Viking ship *Hugin* on its voyage from Denmark to England, and was actually built in an Esbjerg ice cream factory. It is claimed to be unsinkable, will hold 20 people and its enclosed cabin is topped by an aircraft-type glass dome. Air to ventilate the boat and for the diesel engine is drawn down through a hollow mast.

Captain Westborg, who tested out the *Dana Rescuer* in some of the worst North Sea gales, is taking the boat around the world to prove that she can weather seas likely to be encountered in any ocean.

A bachelor from Copenhagen, he plans to call during his world tour at: Colon, Panama, Acapulco, Los Angeles, Honolulu, Johnson Islands, Wake Island, Guam, Cebu, Singapore, Gt. Nicobar, Colombo, Aden, Suez, Port Said, Cairo, Tobruk, Malta, Tunis, Palermo, Algiers, Gibraltar, Lisbon, Coruna, Channel Islands and Le Havre.

Balancing single-cylinder engines

BEGINNER'S WORKSHOP

by Geometer

ALLIED to crankshaft construction for single-cylinder engines, particularly those intended to run at high speed, is the problem of balance, since it is while the crankshaft is being made that provision can best be effected for subsequent balancing. That is, the crankshaft webs can be suitably shaped or extended to avoid the necessity for separate balance weights—with the need for secure mounting to obviate the possibility of their working loose in service.

The need for balancing is obvious on the simple thesis that to start matter in motion requires a force, and to stop it demands another force, while the greater the "weight" of matter and the more sudden the starting and stopping, the greater the forces involved.

In an engine, the major reciprocating parts comprising piston, rings, gudgeon pin and part of the connecting rod, set up forces along their line of travel; and if the engine is unbalanced, the forces, acting through its structure and mountings, set up vibration.

Lightness in the reciprocating parts is important to keep the forces as small as possible. Hence, in high speed engines, it is customary to employ aluminium-alloy pistons, hollow steel gudgeon pins and duralumin connecting rods. In certain types of engine, good balance is achieved in opposing one set of reciprocating parts by another. The flat-twin horizontally-opposed petrol engine and the single-acting vertical twin steam-engine are examples.

In a single-cylinder engine, although it is usual to speak of balancing, complete balance is not possible—the unbalance is shifted from one direction to another. In reference to diagram *A*, a balance weight could be attached to provide a force *W* completely to balance *W*1 set up by the reciprocating parts at top dead centre—and again at bottom dead centre. But the crank being turned at right angles, there is no force to oppose completely that of the balance weight in direction *X*, and at a further half turn in direction *X*1. So the engine would be no less unbalanced than before.

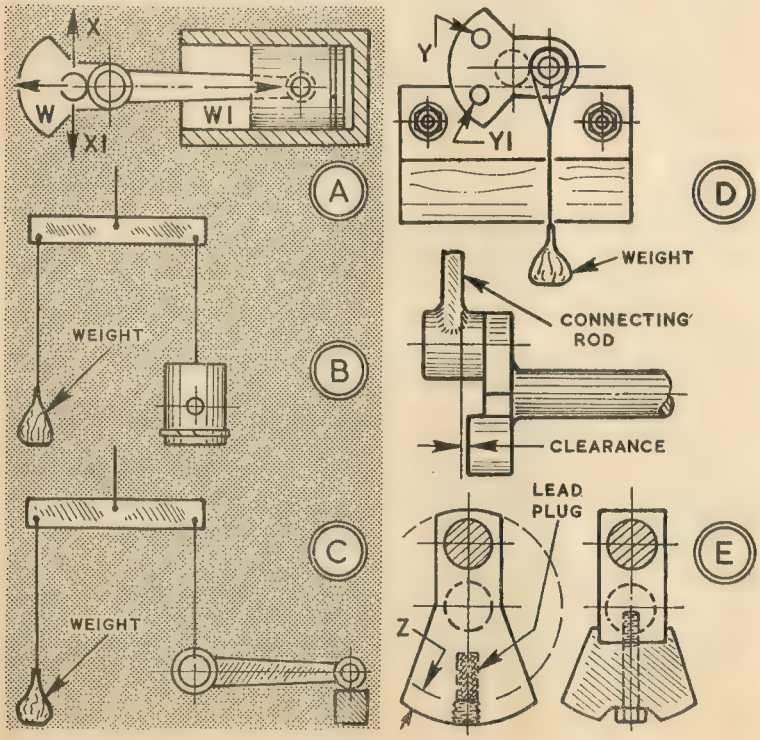
To avoid this, the unbalance is divided, the force *W* opposing only part of that *W*1, and forces acting at *X* and *X*1 are thereby reduced. Usually, the balance weight corresponds to the whole of the revolving masses, which can be balanced, plus half the reciprocating masses. The piston with rings and gudgeon pin are reciprocating masses, so half these weights are taken. The small end of the connecting rod is a reciprocating mass, half of which is taken, too. But the big end is a revolving mass, so the whole of this is taken.

Using a balancing bar and cotton, and steel balls or lead shot in a tissue paper bag, the piston complete is weighed, as at *B*, and half taken. The connecting rod big end is weighed, as at *C*, and the whole of this taken—the small end resting on a block. The small end is weighed similarly, and half taken.

The total number of balls or shot then form a weight which should hold the crankpin horizontal when suspended from it by cotton, as at *D*, with the crankshaft resting on knife edges—which can be strips of steel about 1/32 in. thick bolted each side of a board, and this levelled in the vice.

A heavy balance weight is corrected by reducing its size, or drilling or enlarging holes such as *Y*, *Y*1. Often, however, the difficulty is to provide sufficient weight in the web. The crankpin can be partially drilled to help, and where the crankshaft size is determined by the crankcase, the balance weight can be extended sideways, as far as connecting rod clearance will permit, as at *E*.

Where the shaft runs in the open, the balance weight can be extended radially *Z* beyond the circle swept by the crankpin. For extra weight, a lead plug can be used at times, held in by a steel screw; and where no provision has been made, a steel balance weight can be bolted on. ▣



No model engineer's workshop should be without *Workshop Hints and Tips*, by Geometer, published by Percival Marshall and Co. Ltd, price 3s. 6d. (postage 3d.) U.S. and Canada $1.00.

A lathe you can build . . .

In these further notes MARTIN CLEEVE gives more details of the spindle

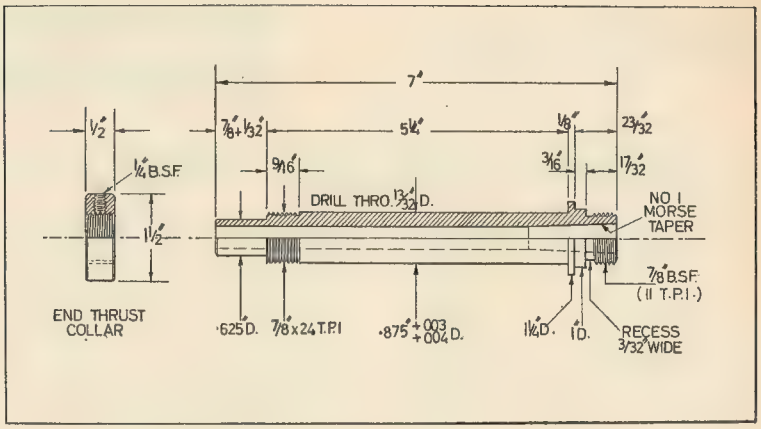


Fig. 1: Details of the lathe spindle for a 2½ in. machine

JUDGING from correspondence received it has been gratifying to find that interest in the small 2½ in. lathe recently described is greater than anticipated; apparently excuses have been found for overlooking the chief deterrent to lathe building: that it needs a lathe to build a lathe. Readers' views upon this particular point would be quite interesting.

For my part, the more I think about it the more attractive becomes the idea of building another—by strict fabrication methods—with all refinements; primarily, for the immense satisfaction it would give to contemplate the finished article; secondly, as a reasonably useful investment of time and outlay; thirdly, as a focal point for friendly debate.

However, despite all these ideals, the matter will have to rest for a lengthly period as I am just approaching the final stages of *Modifications to the E.W. Lathe* during which I have collected over 60 photographs and nearly as many detail drawings through which I am plodding steadily.

It will be worth mentioning here that although the E.W. 2½ in. lathe will form the basis of a series of articles, readers doubtless will be relieved to hear that the majority of the alterations and additions could be applied to any lathe of amateur size. To those readers and E.W. owners who await this series I can but apologise over the time it is all taking.

After that little digression I had better return to the job in hand: the spindle for the fabricated 2½ in. lathe.

The dimensions for this are given in the drawing, Fig. 1. Some readers will notice that it does not quite tie up with some of my earlier remarks upon the question of spindle design, but this is in the interest of simplicity. Thus both bearing diameters are the same, also this spindle is made from mild steel.

There is no doubt that axle steel is a superior material but it is often somewhat glass-like to machine and in many cases it is little short of foolhardy to attempt to bring the bearing surface to size *and* parallel by centre lathe operations—although I have managed to do this for the new E.W. spindle.

For axle steel, final precision grinding is the only really satisfactory method. Of course, axle steel can be annealed to a certain extent but, if possible, it is nice to know that it has not been so treated. Reheat treatment after machining is hardly within the scope of amateur operations.

A refinement

In those cases where high speeds and comparatively heavy loading are anticipated it is a worth-while refinement to slightly increase the diameter of the leading bearing surface. The nose end of the spindle takes by far the greater loading and, in due course, the surface is apt to wear in such a manner that light remachining is called for.

Since, with both bearings of the same size the leading bearing must be large enough to pass the left-hand end of the spindle, it will be seen that this reduction in diameter of the leading bearing surface introduces rather undesirable complications. Together with these must be considered the fact that while compo bushes may be faced and externally machined fairly easily with ordinary h.s.s. tool bits, it puts up a surprising resistance to being bored, especially when light cuts are required.

It seems that with the extra clearance required of a boring tool the edge is soon blunted, while the tip is easily pushed away, the rubbing action being also facilitated by the large quantity of oil contained in the porous material of the bushing. For boring, a carbide-tipped tool is the only satisfactory answer—although it is interesting to note that it can be trimmed off easily with a hand bearing scraper !

I have dealt with these points at some length partly to help the reader to make his own decisions and partly to show that which passed through my mind when designing this particular spindle.

The machining of an accurate lathe spindle calls for some careful work, but if the correct sequences are followed there should be no reason to anticipate failure. Having made quite a number at various times I am able to suggest a suitable mode of attack although it should be noted that I make extensive use of a fixed steady of the bushing type, sometimes with especially made well-fitting bushes and sometimes machining an intermediate semi-finished diameter on the spindle so as to obtain a good running fit in a "standard" steady bushing of unit nominal size.

The bushing steady, as compared with the orthodox three point type, has the merit of being self-centring and of retaining its adjustment over prolonged periods under adverse loading conditions. However, despite these advantages, there are many who prefer the three-point steady. I never tested one myself and I can, therefore, offer no comment except to say that a lathe spindle of any size cannot be made without the aid of a fixed steady of some sort: also required is a chuck which can be set to grip work concentric within very close limits. The following notes will

assume that these conditions can be fulfilled.

Face and centre each end of a suitable length of 1¼ in. dia. stock. Using chuck and tailstock support, rough machine up to what will become the nose and collar shoulder. Leave the ⅞ in. dia. about 25 thou up and the ⅝ in. dia. tail-step about 20 thou up. Here, if a bushing steady is to be used, turn what will be the ⅝ in. step to ¾ in. dia. with a good finish for running in the bush. Also, for bushing type, machine a suitable 1 in. length of, say, 1 in. dia. just behind the nose for future operations.

With the aid of chuck and steady, drill through from both ends: here it pays first to pilot drill ⅜ in. at a high speed and as deeply as possible, following up with the 13/32 in. drill. Use a small boring tool to smooth the inner surface of the drilled hole at the tail end to a depth of about 1 in.

Make a plug to be a slight interference fit to this bored hole and, with the aid of chuck and fixed steady, centre this plug in situ.

Remove the fixed steady. Grip the uncompleted nose end in the chuck, give tailstock support to temporary plug, check for reasonable concentricity at the chuck end and finish machining the ⅞ in. dia., in this case to suit the bore of the uncompressed compo bush (i.e. the bush which will be used on the lathe being constructed). The actual size is best ascertained by machining a test plug until the bushing can be just comfortably slid over. Thread for the end play lock ring. Do not finish machine the ⅝ in. step and do not remove the temporary centred plug. Clear the lathe.

Testing for high spots

Using a known good Morse taper as a reference, set the topslide, if possible, at the rear of the cross-slide in such a manner that a test external taper may be cut with the aid of an inverted turning tool the tip of which is at exact centre height.

Any final small adjustments may be made while machining this test piece, the progress of which may be tested by chalk marking and testing for high spots in the lathe tailstock barrel (best removed for the purpose) or a No 1 to No 2 adaptor if the lathe has a No 2 Morse taper in the tailstock.

When the topslide has been thus set, a boring tool may be substituted and the embryo spindle remounted by chucking the tail end and giving steady support behind the nose. Check the running for concentricity: a ¼ thou total wobble at the tail end (now held in the chuck) would be infinitesimal at the nose end although with a little extra fiddling it is nice to have " spot on " chucking.

The taper may now be bored. When doing this it should be remembered that the amount of metal left to be removed over the 13/32 in. hole is very small so do not set cuts of more than 10 thou depth at the start, and when the test taper (a No 1 m.t. shank drill, end-mill, etc.) shows signs of entering halfway, reduce the cuts to one or two thou depth only. It is annoying to get " caught " and to find that the taper is too deep.

When the bore is nearly complete, the actual fit may be tested by chalk marking the test plug with three parallel lines spaced at about 120 deg. Here it should be noted that a freshly turned taper bore often shows apparent errors due to the comparative roughness of the tooled surface, so the final cuts should be very light and taken at a fairly high speed with a feed as uniform and as slow as patience will permit.

Remaining apparent or slight errors may often be corrected well enough for all practical purposes by winding a strip of fine, partly worn Carborundum cloth over the taper shank and using as an improvised reamer. Of course, should the reader really doubt his ability it would be as well to have a rehearsal bore upon an odd piece of stock to get the feel of the job.

Upon completion of the above operations everything will have been done with the exception of machining the spindle nose and finish machining the ⅝ in. step at the tail end. The reason for leaving this ⅝ in. step until last is that the larger diameter may be gripped in the chuck rather more fiercely than for ordinary turning, in order to ensure against slipping during threading the nose: chuck marks or accidental skives may be machined off the ⅝ in. step as a last operation prior to the removal of the plug.

When threading the nose, if a bushing steady is in use, it should give ample and reliable support, but if the steady is of the three point type it would be as well to give additional support from the tailstock with the aid of the appropriate centres of the male and female type, first making sure that the point projecting from the lathe spindle is running dead concentric: machine in situ if necessary, then run in a hardened female centre held in the tailstock.

At first sight it may appear that much of the juggling with fixed steadies and temporary machined diameters is unnecessary. Strangely enough, during the course of drafting these notes (which took about six times as long to prepare as it would have taken me to make another spindle) I had to keep referring back and rereading to find out just why. For instance, drilling right through *might* distort the spindle: I have not found that it does, but who would care to take the unnecessary risk of carrying out this operation after, instead of before, other precision work is done.

If the spindle is of high-tensile steel and it is desired to have the bearing surfaces precision ground this should be carried out after drilling through and having made a temporary plug for both ends. Some prefer to have a temporary plug at one end and to have the Morse taper finished, sending the spindle away with a " live centre " inserted; the question as to whether it is preferable to machine the taper before or after grinding (or turning) the main bearing diameters is open to debate, and much could be said in favour of either.

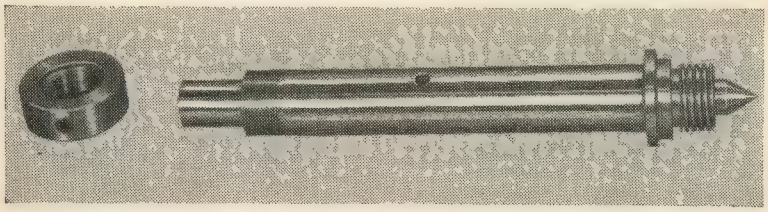
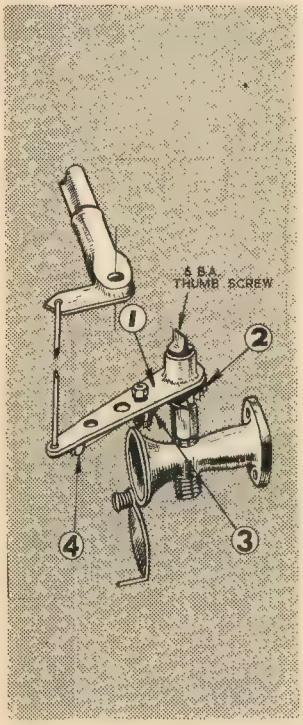


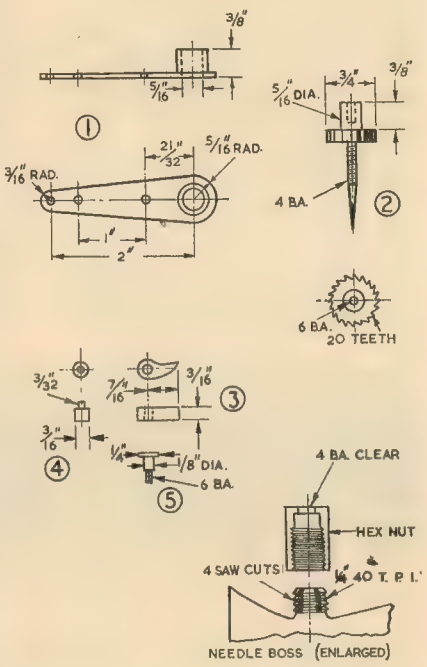
Fig. 2: The finished spindle and collar

Those who may be interested in the cutting characteristics of tough high-tensile steel will be glad to know that within my own experiences, short lengths, taper bores and threads can all be machined and polished to size with confidence, using ordinary high-speed steel tools. I think the reason for this is that, over short lengths, the tool is able to complete the cuts before breaking down; attempts to machine important lengthy surfaces often result in the tool failing at the halfway point. Carbide-tipped tools also cannot be fully relied upon to give the desired finish under the exacting double requirements of sizing within ¼ thou and to give a smooth surface.

Compo oil-retaining bronze bearings or bushings, both plain and flanged, are obtainable from the manufacturers, Bound Brook Bearings, Trent Valley Trading Estate, Trent Valley Road, Lichfield, Staffs. ▣

Carburettor adjustment





ADJUSTING the needle valve on a hydroplane while it is circling the pole is often a necessary but impossible task.

I have always found that the mixture needs to be very rich during the getaway, but after about one lap the engine is still not reaching maximum revs. All one can do is to top the boat and readjust.

The following is a description of a simple device to overcome this.

The needle valve is fitted with a small ratchet wheel (No 2 on the sketch) on which swings an arm (No 1) fitted with a pawl and flat spring. The arm in turn is actuated by a lever which protrudes at right angles to the hull (similar to a knock off switch).

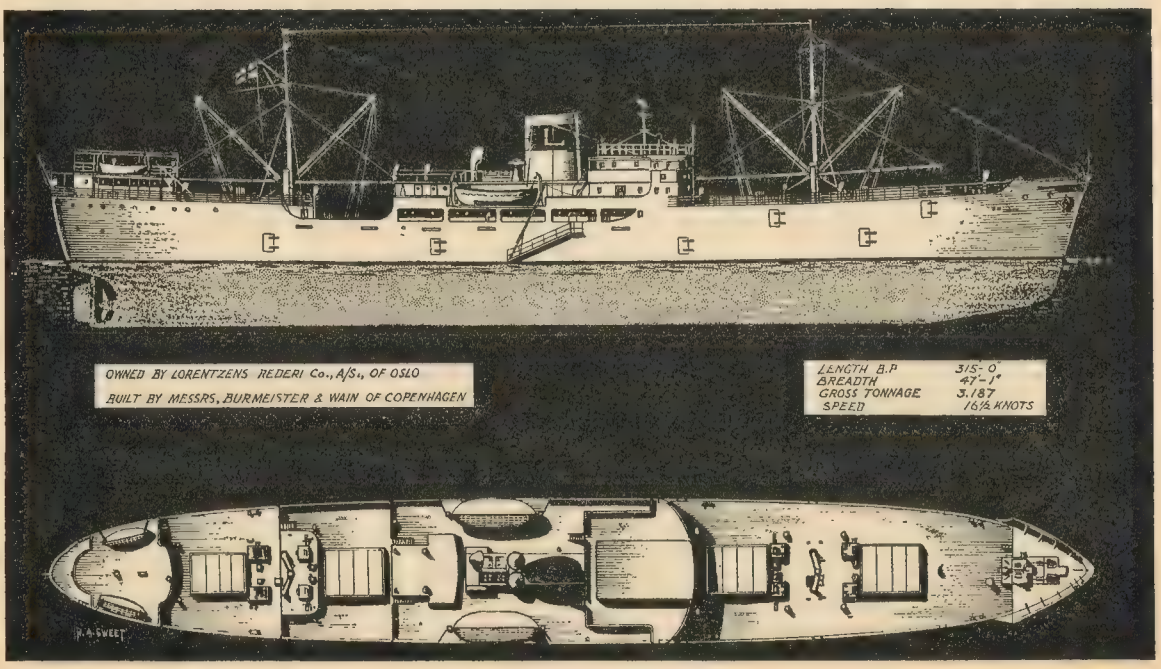
This lever is spring-loaded and returns to a reset position immediately the operator has moved it back, thereby screwing down the needle valve one ratchet tooth on the wheel.

The device should be adjusted so as to move the needle one ratchet tooth at a time.

The needle valve stem should have some friction to stop the valve from moving once it has been moved by the pawl and arm Nos 1 and 3.

The enlarged sketch explains how this friction is obtained and adjusted. Four sawcuts are made in the boss, which closes in on the needle valve stem when the special hexagon nut is tightened. ■

SHIP SHAPES — *REFRIGERATED MOTORSHIP "JESSIE STOVE"*


OWNED BY LORENTZENS REDERI Co., A/S., OF OSLO
BUILT BY MESSRS, BURMEISTER & WAIN OF COPENHAGEN
LENGTH B.P 315-0
BREADTH 47-1"
GROSS TONNAGE 3,187
SPEED 16½ KNOTS
P.A. SWEET

THE M.E. SPEEDBOAT COMPETITION (1956-7)

M. de B. Daly (assisted by J. H. Benson) starting NIPPER II *at Wicksteed Park*

THE results of the MODEL ENGINEER speedboat competition, held under the revised rules announced earlier in the year, show that steady progress has been maintained in the performance of racing boats, though no spectacular speeds have been recorded.

However, the figures given here may not be considered truly representative, as several of the boats which have achieved very high speeds—in more than one case well over the seventies—have not been entered in the competition, and, indeed, the number of entries do not bear any true proportion to the numbers which have been seen in action during the past year, or indicate the amount of interest in this highly competitive branch of model engineering.

There is no doubt that success in the model power boat racing sphere is just as difficult to achieve as ever, if not more so; and although there have been a few isolated cases where boats have achieved high speeds almost immediately and apparently with ease, the great majority have called for long and patient development work, including much trial-and-error experiment with hull, engine and propeller before the best results were attained. This, of course, is generally true in all racing craft or vehicles, whether full-size or model, and those who have sought to find a short cut to success have usually been disillusioned.

Under the new competition rules, speed alone has not been the deciding factor in the placing of the boats; they have been judged on a points system in which design, workmanship and originality have also been taken into account. It is not proposed to give a full analysis of the judging, but the total number of points awarded in each case are shown in the table of results. Some observations on the assessment of points, however, may be of interest.

Not only has the highest speed been achieved by M. de B. Daly's *Nipper* 2, which incidentally is now a B class record holder, but it rates highly for design and originality, in view of the distinctly individual features of the engine and the device for counting revolutions when actually under way; these will be referred to later.

Colin Stanworth, a young but progressive and determined competitor, also gains points for the design of *Cocotoo*, the hull of which is designed to cut down air resistance by blending the contour of the twin silencers into fore-and-aft deck fairings. He also has an ingenious method of attaching the outboard planes by means of a torsion bar spring of ¼ in. high tensile tube, which provides resilience against the heavy buffeting encountered at high speed and some flexibility in the angle of incidence, which automatically varies with the speed.

Norman Hodges' *Rita* 3 shows high workmanship and finish, and the results obtained are specially notable in view of the curtailment of his activities during the past season, as a result of personal injuries. This does not, however, imply any odious comparison in respect of other boats, where no special mention is made of these features.

Norman Hodges' A class boat RITA 3

HULL DESIGN

No special innovations in hull design are seen in these entries, which follow the general trend in principles and constructional methods which have been evolved in the post-war period.

The so-called "three-point" principle of planing, on two main supporting surfaces abreast, forward of the centre of gravity, and the propeller tip at the stern, seems to be universally established as the most efficient for these models; a narrow

M.E. SPEEDBOAT COMPETITION . . .

rear planing surface under the stern is sometimes used to maintain a reasonable attitude initially until speed is high enough for the surface propeller to take over.

Separate side planes, spaced well away from the main hull, are most popular, as it is generally conceded that these help to reduce the effect of air lift under the hull, which is liable to cause it to "flip" or somersault backwards at high speeds. Integral or closely attached "sponson" planes are, however, used in *Orthon* and *Rita* 3. Up to the present, exact rules or governing principles of detail design in such matters as planing areas and angles, centre of gravity, length-beam ratio, etc., have not been established, and considerable variation is seen in individual hulls.

Construction is almost universally in wood, using cut-out or fabricated frames or formers, with longitudinal stringers, and covered with thin three-ply, but metal reinforcement at highly-stressed points is common. Fairings for upper parts of hulls, to reduce air resistance, is often in balsa wood, but except in the case of *Cocotoo*, this has not been found very satisfactory for main structures or underwater parts. Experiments in the use of plastics—glass fibre in particular—are going ahead, but none of the boats entered uses this form of construction.

PROPELLERS

The fully submerged propeller is now entirely obsolete for model racing boats; in all cases the propeller is arranged so that its shaft line is well above water level at the planing attitude of the hull. This enables larger propellers to be used, and reduces risk of stalling as the boat gets away, but implies no fundamental difference in the design of propellers, as such. Blade shapes and areas vary widely, and there is no closer agreement in diameter and pitch, which do not appear to bear any definite relation to the engine capacity. In all cases, a single propeller is employed.

Some very interesting observations are made on propeller speed and efficiency by M. de B. Daly, based on information obtained with the revolution counting device in *Nipper* 2. This employs a reduction gear train having a ratio of 250 to 1, driven from the propeller shaft, and operating, by means of a crank, a white metal plate or "flag" on the side of the hull. By means of a stop watch, the rate at which this rises and falls can be counted, and the engine speed calculated.

Several different propellers have been tried and the results compared. In the run recorded for this competition, the engine speed was 14,300 r.p.m., and by working out the theoretical speed with a propeller of 6¼ in. pitch, it will be seen that the propeller efficiency is 78 per cent. or, in other words, the slip is 22 per cent. Under rough water conditions as much as 32 per cent. slip has been observed, due to the propeller coming right out of the water at times; but generally speaking, the results indicate that surface propellers have no greater slip than the submerged type.

Colin Stanworth's C class boat COCOTOO

ENGINE DESIGN

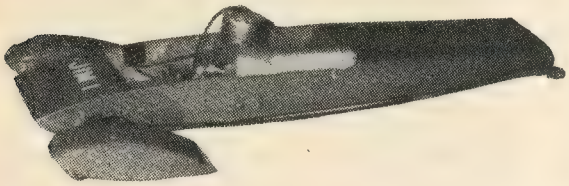
All the boats entered have single-cylinder two-stroke engines, with glow plug ignition, and most of the main features of design follow what may be described as "conventional" practice. Deflector type pistons are still the most popular, and admission is usually by rotary valve, of the disc type—notable exceptions in both respects being in the case of *Nipper* 2's engine. This has a dome-topped

Left: M. Daly and NIPPER 2

Right: Colin Stanworth starting COCOTOO *at Victoria Park*

Right: *J. H. Benson with* ORTHON *at Victoria Park*

Below: *A. J. Hampton's C class boat* JIM 1



piston, with 180-deg. exhaust and transfer porting, and admission is by a reed valve of the "petal" type, made in one piece of beryllium-copper alloy 0.004 in. thick, covering eight ports ¼ in. dia. equally spaced round the face of the crankcase endplate.

A sidelight on the incidental troubles encountered in the development of fast boats is given by Colin Stanworth, who describes experiments with the fuel tank air vent in *Cocotoo*. Fuel feed often presents difficulties under the effects of both acceleration and centrifugal force, fuel thus piling up at the sides or end of the tank and causing either starvation of the engine or excess richness of mixture. These troubles are often mysterious and elusive, but can be countered or alleviated by modifying the design and location of the tank.

In the particular case referred to, however, a third inscrutable factor appeared, due to air pressure conditions in the region of the air vent. This was originally flush with the deck, between the silencer fairings, but airflow at this point caused a reduction of pressure which resulted in starving the engine completely at over 50 m.p.h. To counter this, a forward-facing vent was fitted, but the increased air pressure caused flooding. The vent now points about 45 deg. across the airstream, which strikes a happy medium—and it is possible to obtain mixture control by varying the angle! This, it may be noted, is only *one* of the little things which have to be dealt with in developing a successful speed boat.

PERSONAL NOTES

Both M. de B. Daly and John Benson are members of the Blackheath Model Power Boat Club, the latter being well known also as competition secretary of the M.P.B.A. His boat *Orthon* has had a consistently successful career over the last three seasons, but unfortunately it is now wrecked. Norman Hodges, formerly of the Orpington M.E. Society, now belongs to the Victoria M.S.C. Though now living in the Farnborough area, Colin Stanworth is still a member of the Bournville M.Y. and P.P.C., and A. J. Hampton, a comparative newcomer to model power boat activity, belongs to the Portsmouth and District M.P.B.C.

All these competitors have built the hulls and engines of their boats with very limited equipment despite the exacting requirements in the precision of engine components. The engine of *Nipper* 2 was built with the aid of a 3 in. Portass lathe, now about 25 years old, and a B.T.M. watchmaker's lathe, plus the use of a milling machine for cutting the cylinder block and crankcase from solid duralumin, as no castings were used in this engine.

The absence of boats driven either by four-stroke i.c. engines or flash steam is to be deplored in view of the part these power plants have played in the development of model speed craft in the past. In the early pioneer days, the only possible means of attaining sufficient power to drive a hydroplane successfully was by flash steam and, without its aid, there is doubt whether such boats would ever have made progress.

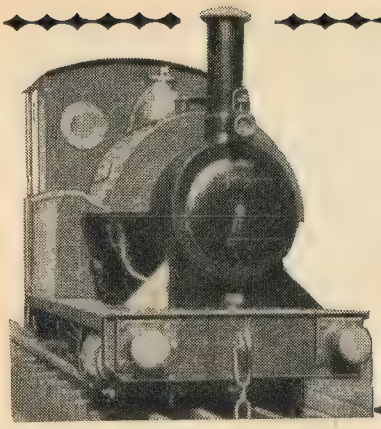
The potentialities of both these forms of power are by no means exhausted, and it is to be hoped that interest in them will be revived. Most modern constructors turn to the two-stroke engine as apparently the simplest type to build and tune up, but this view is not necessarily the correct one, and the line of least resistance is not always the highway to efficiency.

All entrants in this competition have attained a speed well above minimum requirements, and quality for certificates of performance. ▣

THE RESULTS

Name of boat	Owner	Total Weight lb.	ENGINE		HULL		PROPELLER			Speed m.p.h.	Points max. 150
			Bore	Stroke	Length in in.	Max. beam in in.	Dia. in.	Pitch in.	Area each blade sq. in.		
*Nipper 2 (Class B) ...	M. de B. Daly	5½	1½ in.	⅞ in.	28½	10½	3	6½	0.9	66.66	103
†Cocotoo (Class C) ...	C. G. Stanworth	4⅜	1.005 in.	0.76 in.	29	9	2⅜	9	0.34	59.00	98
Rita 3 (Class A) ...	N. F. Hodges	9¾	1 7/16 in.	1½ in.	35½	10	3½	11	—	60.19	94
Orthon (Class A) ...	J. H. Benson	8½	1 7/16 in.	1⅛ in.	34	11½	3¾	9	1	63.38	90
Jim 1 (Class C) ...	A. J. Hampton	4⅜	1.015 in.	0.75 in.	29	10½	3	6	0.6	51.65	80

* Silver Medal
† Bronze Medal



JIMPY

F. C. GENT built this fascinating little engine —with the help of a friend's lathe, the M.E. Queries service and his wife's knowledge of firing!

Platelayer's view of JIMPY

SOME YEARS AGO, having made two gauge 1 spirit-fired locomotives, I decided it was time I turned my attention to a coal-fired passenger hauling engine. A 5 in. gauge seemed to be the most suitable size to meet my requirements.

Owing to the layout of the garden, the space available allowed only about 45 ft of portable track, running straight along a path with a gradient of 1 in 33. A short engine was necessary to give a reasonable length for running, otherwise it meant all engine and no length of track.

Eventually the choice fell on an 0-4-0 saddle-tank Falcon engine. Being a motor engineer it held no apparent obstacles and two years' spare time was decided upon as a fair estimate. I must admit to quite a lot of other jobs and spare time occupations, and my estimate was well and truly out!

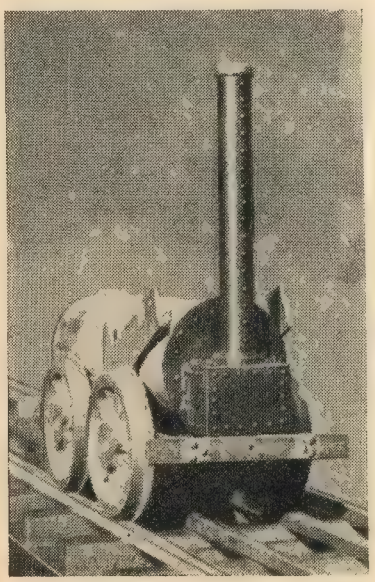
Equipment consisted of the usual small tools, with an Adept $1\frac{5}{8}$ in. lathe, and the use of a 5 in. metal-turning lathe. The latter is about 80 years old, has no back gear and is driven through a countershaft by an Austin 7 h.p. engine. It is accurate to about 1/64 in., if both lathe and operator are in the same frame of mind! However, I have known it for a long time, and it has one good point: it is solid, and turning parts out of the solid can be accomplished without protest or damage. A number of parts were roughed out and then finished on the Adept.

At this time a daily newspaper was running a strip cartoon depicting the adventures of Jimpy, a little magician, and it was decided to name the locomotive *Jimpy* in the hope that it, too, might be a little magician!

Work on the frames, buffers and coupling hooks was soon accomplished. Patterns were made for the wheels and cylinder castings, which were cast locally then machined and fitted up. The cylinders are $1\frac{1}{16}$ in. bore × $1\frac{7}{8}$ in. stroke. (The bore should have been 1 in., but as one bore came out bell mouthed, the cylinder bores were enlarged to $1\frac{1}{16}$ in.) First round to the 5 in. lathe!

Connecting and coupling rods were made by following L.B.S.C.'s instructions for the *Maid of Kent*; in fact, throughout the whole job I have

The partially-completed INVICTA



JIMPY, *with driver and guard, undergoing early steam trials*

taken full advantage of his helpful series, and all fittings are to the "words and music." Stephenson's valve gear was fitted, and worked well under compressed air when tested.

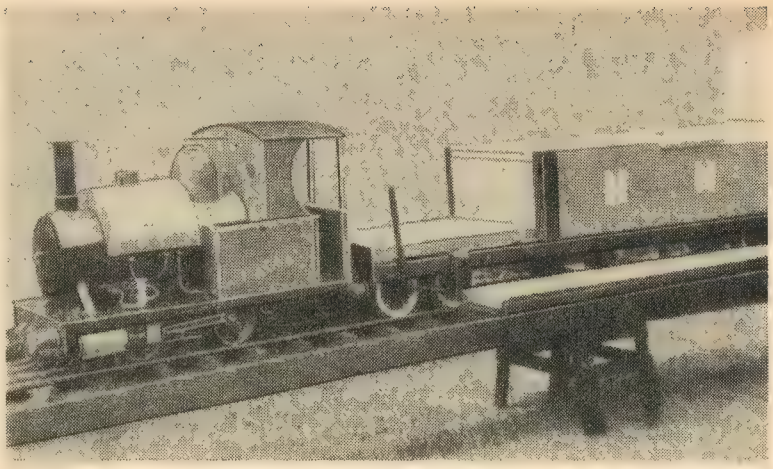
About this time *Invicta* was being described in MODEL ENGINEER and it appealed to me so much I laid *Jimpy* on one side, and commenced operations. Frames, wheels and boiler were quickly made up, with a number of rivets around the chimney and firebox front to give a little more detailed appearance. I like to see plenty of rivets on an engine !

By this time, however, grandchildren able to move under their own steam were on the scene, and I decided that I must get back to my former job before they grew up and lost interest.

The boiler, which is 13 in. long and 4 in. dia., was made in the winter, an ideal time for brazing a boiler this size. Flue tubes ½ in. dia. were fitted, no provision being made for a superheater, other than a coil in the smokebox. This arrangement has given a good steamer and the flues are easily cleaned, but the engine is definitely "wet" until it has run for some time.

The dome casing was made in three pieces, the main portion being a tube flanged to fit the boiler, which is lagged. The domed portion was beaten out and brazed on, the whole casing being held down by a screwed ring fitting on to the safety-valve body in the top of the dome itself.

The smokebox is an old Ford dynamo casing bored out with a front brazed in and the chimney is a piece of waterpipe, turned to size and shape, flanged at one end and riveted to the smokebox, and fitted with a copper cap.



Showing the truck specially designed to transport children and adults in complete safety. Note the sturdy running boards

Eventually the day arrived to raise steam. Some promising looking coal was broken up and the fire lit with small pieces of wood. A thick cloud of smoke covered the area, and, after furious efforts with a handpump as a blower, enough steam was raised to just move the locomotive along the track.

Drawn to the scene by the fog and smell, my wife, who loves a fire and could persuade granite to burn, diagnosed insufficient draught, so the firebars were removed and wider spacers fitted, with an immediate improvement, although the fog persisted. A letter to Readers' Queries in M.E. finally solved my problem, and following the advice given, anthracite was used with the result that I have plenty of steam and no smoke to bother about.

The one piece of rolling stock, again follows an article in M.E. A truck body was made, cut away at the front for easy stoking, and supplied with loose seats and running boards for passengers to sit astride. Small children can sit inside quite safely, and a back rest is provided to stop adults from slipping off.

Owing to seating accommodation maximum load so far has been three adults; a load which, as is to be expected, is no trouble at all to *Jimpy*. Although the 1 in 33 gradient can be climbed, it was found to be less hectic to make a number of metal stands for the portable track and to keep to level running.

The track is arranged to take 1¼ in., 1¾ in., 3½ in. and 5 in. gauge stock, so I have plenty of choice for future jobs ! ▣

A simple indicating pressure switch

A reliable device for laboratory use

THERE is often the need in laboratories for a pressure switch which cuts in and out at certain pressures, its accuracy not being of great importance. The pressure switch described here has been specially designed for such a purpose.

It consists of a Bourdon pressure-gauge, the end of the tube being connected to a microswitch. The microswitch can be adjusted in such a way that a switching operation takes place at, for example, 0.7 atm. gauge = about 10.5 p.s.i. The microswitch can be fixed to the pressure-gauge in any desired place.

In order to fit the finger *CD*, the front of the pressure-gauge is removed and a hole is drilled in the rear of the gauge housing. The diameter of the hole must be such that the maximum deflection of the pointer *CD* is guaranteed.

The advantages of the device lie mainly in its operational reliability, on account of its simplicity of design, and in the low costs which the design entails.

This has been condensed by Technical Digests from an article by J. Schutten in the Netherlands journal, "Chemisch Weekblad." ▣

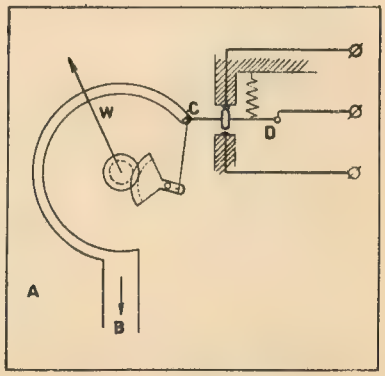


Diagram of the pressure switch

MYRMIDON

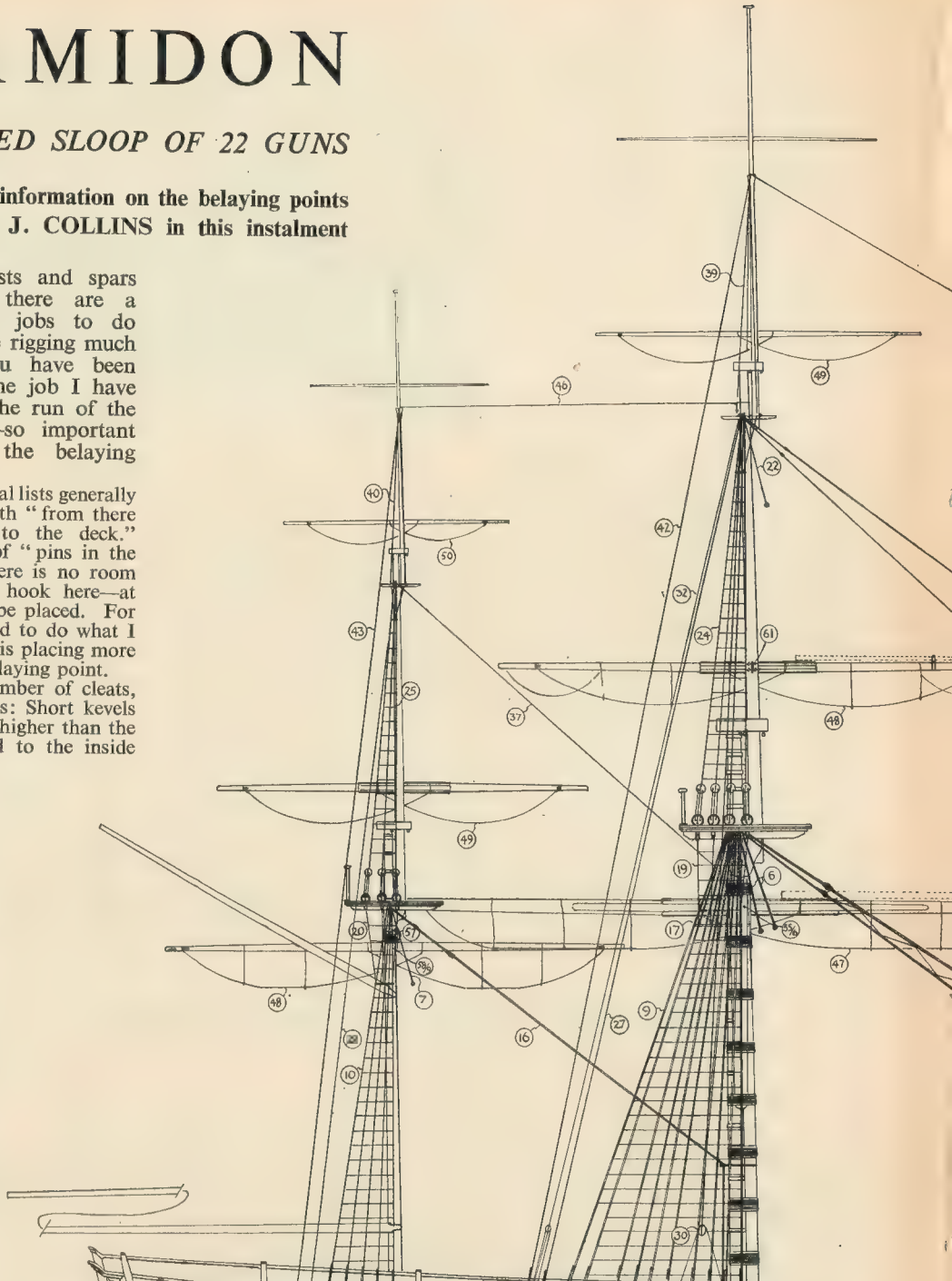
A SHIP-RIGGED SLOOP OF 22 GUNS

Part 6—That vital information on the belaying points is supplied by R. J. COLLINS in this instalment

WITH the masts and spars completed there are a number of jobs to do which will make the rigging much easier. While you have been working hard on the job I have been busy tracing the run of the various lines and—so important this—finding out the belaying points.

As is usual the official lists generally content themselves with "from there down" or "down to the deck." There is a mention of "pins in the breast hook" but there is no room for an upper breast hook here—at least where pins can be placed. For that reason I have had to do what I don't like doing, that is placing more than one rope to a belaying point.

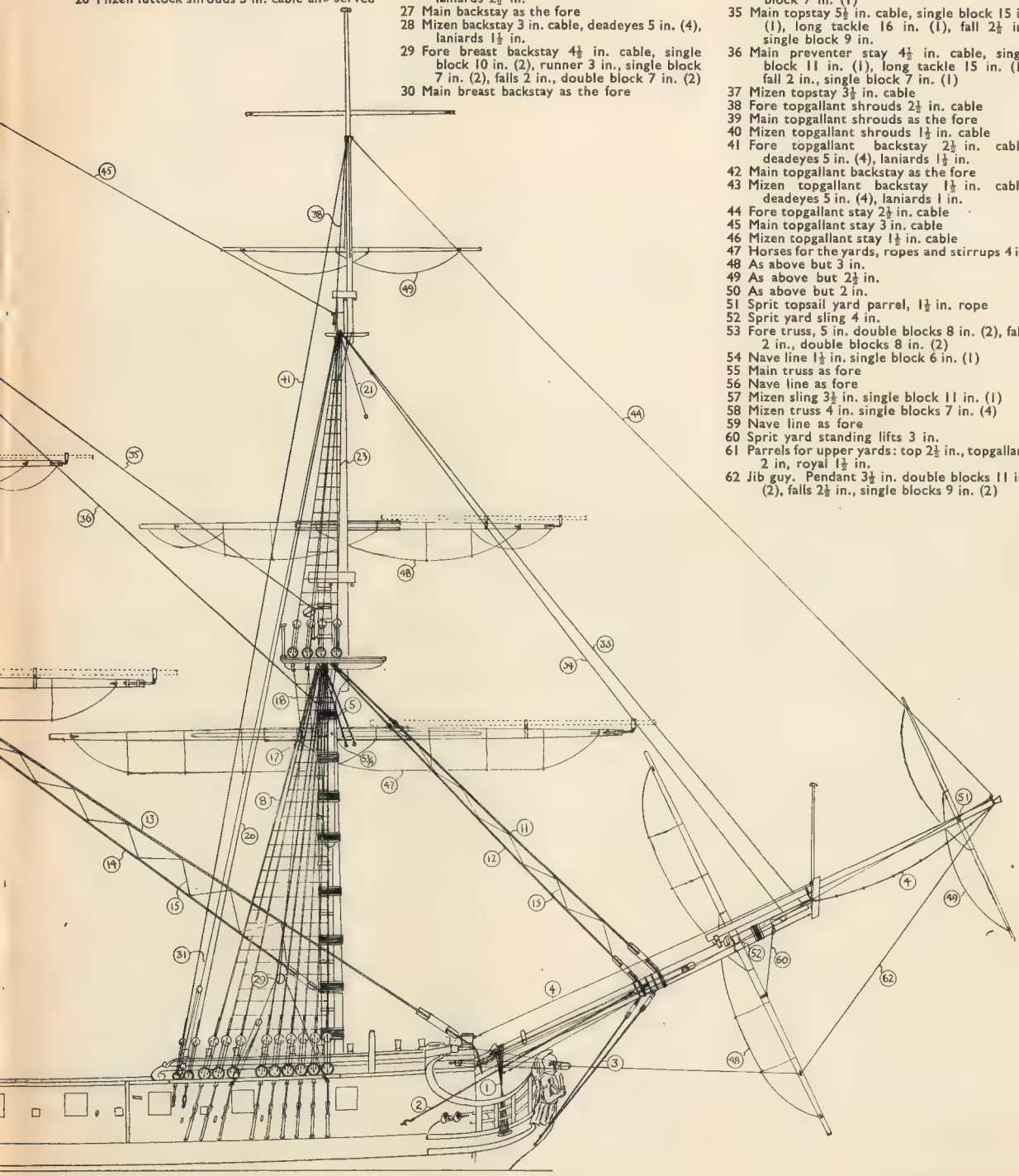
I have placed a number of cleats, kevels, etc., as follows: Short kevels (Fig. 71) reaching no higher than the timber heads fastened to the inside



Standing Rigging

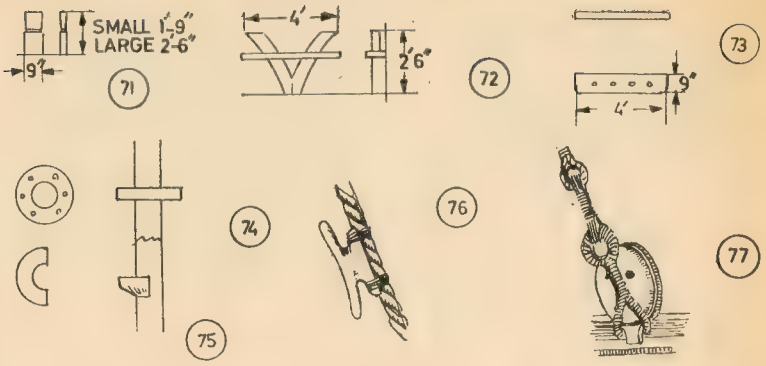
1 Gammoning 5 in.
2 Bowsprit shrouds 5 in. cable, served, hearts 7 in. (4), laniards 2½ in.
3 Bobstays 6 in. cable, served, hearts 7 in. (4), laniards 3 in.
4 Horses 3 in.
5 Fore tackle pendants 7 in. cable, served
6 Main tackle pendants as the fore
7 Mizen tackle pendants 3½ in. cable, served
8 Fore shrouds 7½ in. cable, deadeyes 11 in. (36), laniards 4 in., ratlines 1½ in.
9 Main shrouds as the fore, deadeyes (40)
10 Mizen shrouds 4½ in. cable, deadeyes 7 in. (20), laniards 2½ in., ratlines 1 in.
11 Fore stay 11 in. cable and wormed, hearts 14 in. (2), collar 5½ in., laniard 4 in.
12 Fore preventer stay 7 in. cable and wormed, hearts 11 in. (2), collar 4 in., laniard 3 in.
13 Main stay 11½ in. cable and wormed, hearts 16 in. (2), collar 8½ in. laniard 4 in.

14 Main preventer stay 8 in. cable and wormed, hearts 12 in. (2), collar 4½ in., laniard 3 in.
15 Snake lines 3 in.
16 Mizen stay 3½ in. cable and wormed, collar 2½ in., laniard 1½ in.
17 Catharpins 4 in. served
18 Fore futtock shrouds 4½ in., cable and served
19 Main futtock shrouds as the fore
20 Mizen futtock shrouds 3 in. cable and served
21 Fore top tackle pendant 3½ in.
22 Main top tackle pendant as the fore
23 Fore top shrouds 4½ in. cable, deadeyes 7 in. (16), laniards 1½ in., ratlines 1 in.
24 Main top shrouds as the fore
25 Mizen top shrouds 3 in. cable, deadeyes 5 in. (12), laniards 1½ in., ratlines ¾ in.
26 Fore back stay 4½ in. cable, deadeyes 7 in. (4), laniards 2½ in.
27 Main backstay as the fore
28 Mizen backstay 3 in. cable, deadeyes 5 in. (4), laniards 1½ in.
29 Fore breast backstay 4½ in. cable, single block 10 in. (2), runner 3 in., single block 7 in. (2), falls 2 in., double block 7 in. (2)
30 Main breast backstay as the fore
31 Fore shifting backstay 4½ in. cable, single block 8 in. (2), falls 2 in., double block 8 in. (2)
32 Main shifting backstay as the fore
33 Fore top stay 5 in. cable, long tackle block 16 in. (1), fall 2½ in., single block 8 in. (1)
34 Fore top preventer stay 4 in. cable, long tackle block 15 in. (1), fall 2 in., single block 7 in. (1)
35 Main topstay 5½ in. cable, single block 15 in. (1), long tackle 16 in. (1), fall 2½ in., single block 9 in.
36 Main preventer stay 4½ in. cable, single block 11 in. (1), long tackle 15 in. (1), fall 2 in., single block 7 in. (1)
37 Mizen topstay 3½ in. cable
38 Fore topgallant shrouds 2½ in. cable
39 Main topgallant shrouds as the fore
40 Mizen topgallant shrouds 1½ in. cable
41 Fore topgallant backstay 2½ in. cable, deadeyes 5 in. (4), laniards 1½ in.
42 Main topgallant backstay as the fore
43 Mizen topgallant backstay 1½ in. cable, deadeyes 5 in. (4), laniards 1 in.
44 Fore topgallant stay 2½ in. cable
45 Main topgallant stay 3 in. cable
46 Mizen topgallant stay 1½ in. cable
47 Horses for the yards, ropes and stirrups 4 in.
48 As above but 3 in.
49 As above but 2½ in.
50 As above but 2 in.
51 Sprit topsail yard parrel, 1½ in. rope
52 Sprit yard sling 4 in.
53 Fore truss, 5 in. double blocks 8 in. (2), falls 2 in., double blocks 8 in. (2)
54 Nave line 1½ in. single block 6 in. (1)
55 Main truss as fore
56 Nave line as fore
57 Mizen sling 3½ in. single block 11 in. (1)
58 Mizen truss 4 in. single blocks 7 in. (4)
59 Nave line as fore
60 Sprit yard standing lifts 3 in.
61 Parrels for upper yards: top 2½ in., topgallant 2 in, royal 1½ in.
62 Jib guy. Pendant 3½ in. double blocks 11 in. (2), falls 2½ in., single blocks 9 in. (2)



MYRMIDON

continued



of the fo'c'sle bulwarks between timber head 4 and 5 (opposite the mast) and between 9 and 10 (the last two); an eyebolt on the channel between and behind the ninth and tenth, and tenth and eleventh deadeyes, with a large ringbolt aft of the mast and a smaller one each side of it about 1 ft away. The cross pieces of the bitts are to be drilled to take four pins each.

The three cleats in the waiste I have already mentioned. But there is a large ringbolt aft of the main mast and a smaller one each side of the mast. The main bitts will take five pins each.

On the quarter deck there is a kevel inside from the third and fourth main deadeye, another inside from the topgallant deadeye and a third inside from the second mizen deadeye.

There is a staghorn (Fig. 72) between the gun port and the mizen channel.

Between the first two kevels are two pin rails (Fig. 73) each holding four pins, and there is a small vertical cleat on the port side between the gun port and the second kevel, and one on the starboard side a couple of feet aft of the after rudder block. On an imaginary line 1 ft from, and parallel to, the quarter deck bulwarks and starting just abaft the mizen mast, is a ringbolt, with a fore and aft cleat 4 ft aft of it; a 2 ft gap, and then another ringbolt with a fore and aft cleat 4 ft aft of it. Then 6 ft aft of that is a third cleat.

Around the mizen mast, 3 ft from the deck, is a rack holding six pins (Fig. 74). You may find it best to cut this from ply, in which case you must paint it to hide the laminations. Be sure to secure it well. Since writing the description of this mast I have decided to include a saddle (Fig. 75) on which to rest the driver boom. Steele does not mention one, but Darcy Leaver does.

Right aft, on the inside of the taff-rail, are three vertical cleats aside a ringbolt on the outer corner on top of the rail, another on the rail above the first cleat and another on the inside above the rudder housing, with a cleat to the starboard of the housing just clear of it.

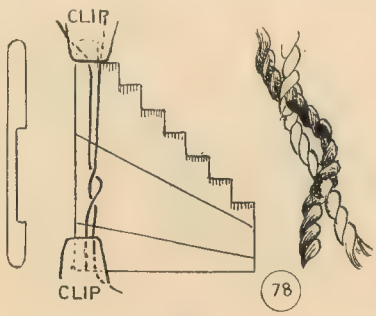
The main channel has a ringbolt behind and between the tenth and eleventh, and eleventh and twelfth deadeyes. The mizen channel has one behind the first pair and another one behind the last pair of deadeyes.

Further belaying points are in the form of cleats fastened to the fore and mizen shrouds about 4 ft from deck level (Fig. 76). I give a figure of these and suggest that they be glued into position and, when set, securely lashed. These go on the fore shrouds, No 2, 3, 5 and 6, and on all the lower mizen.

At this stage it is also easier to hang the blocks under the tops. It is probably best to make the strops of wire, pass them through the holes, insert a toggle and give the block a twist. The fore top has six blocks in front, three aside and a similar row aft. Counting inwards there is an 8 in. double which takes the leech line and the sprit yard brace, another 8 in. double which takes the two buntlines and an 8 in. single for the sprit topyard brace.

The main top has only the two doubles aside in the front row and the outer double in the back. The first takes the leech line through the outer sheave and the second block takes the buntlines.

Both tops have the 6 in. nave line block slung from the centre of the after cross tree; for this the top will have to be drilled. They could be hooked to an eyebolt beneath as the figure shows. On the upper surface of both fore and main tops is a row of four eyebolts in line with the after deadeyes. These are for the reefing tackles and topgallant haliard. Actually, they should be served



thimbles. There is only one on the mizen top.

The blocks for the yards can be seen from the running rigging plan. I think I should attach the thimbles for the topgallant shrouds (Fig. 77) to the first and third topmast deadeyes at this stage. Thimbles and blocks around the masts for the various stays can also be fitted before the masts are stepped. Details of these are shown in the standing rigging.

To me, the greatest beauty of a ship model lies in its rigging. Yet so often it is spoiled by lack of a little thought. The faults most often met with are too-heavy masts and yards—yet they are in the rigging picture—and likewise the ropes and blocks.

In the description that follows I give exact sizes although I know that few of us can make up ropes correct to a half-scale inch. Thus, they have to be made as near as possible *below* the size. I also show, when I can, the manner in which the real things were done . . . the correct knots, etc. I would rather leave any simplification to you, because at least you will know how it should be done.

On the ship very few blocks were spliced directly to their ropes, but on a model it is rare to find all the (relevant) blocks stropped. Dr Longridge took advantage of the fact that the strops were served and made them of wire, the serving hiding the ruse. Of course, his model was not only of a larger ship but to a larger scale. Wire strops if soldered and painted black, even if not served, seems to me a good idea.

I show a method of making rope strops. Wind a length of thread around the jig to the appropriate size. Pass them both, one through the other, pull tight and hold with clips and rub a little gum into the joint. Leave a short length on each end when trimming so the serving will help to hold. The splice should be served in any case (Fig. 78).

● *To be continued*

ZOE

This week L.B.S.C. describes how to make and erect the running gear for the 1¾ in. gauge passenger-hauling engine

THE hornblocks should be fitted to the frames before they are permanently erected, to ensure that each side will be in correct alignment. They are the type and size which I usually specify for 2½ in. gauge locomotives, and also for small engines running on a wider gauge, such as *Tich*. I recommend the hot-pressed variety as they require no machining.

As the openings in the frame have rounded corners, as in full-size practice, which eliminates the chance of frame cracks starting from sharp corners, the top edges of the flanges on the plain side of the hornblocks must be filed to suit. The holes for the rivets should be drilled No 41 in the position shown, and any burring filed off.

If castings are used, the plain side will need milling off to bed against the frames. The easiest way to do this, if a vertical slide is available, is to bolt the hornblock to the slide, plain side outwards, and traverse it across an endmill or slot-drill in the three-jaw chuck.

Beginners may be interested to know that in the description of *Tich*, which was a most suitable job for those new to the hobby, I described in full detail, with plenty of illustrations, every job in the construction of the engine. That for milling the hornblocks showed the casting attached to the vertical slide by a flanged block in the slot, just like an axlebox with a single flange, a bolt through the hole attaching the lot securely to the vertical slide.

The job could also be done on a vertical milling machine by bolting the casting to the table in similar fashion, and using an endmill or slot-drill in the spindle. Failing any method of machining, the contact faces can be smoothed off with a file; it only requires a little patience!

Fit the hornblocks carefully to the openings in the frame; the lugs should stand just clear of the bottom edge. Hold in place with a toolmaker's cramp, then drill the No 41 holes in the frame, using those in the hornblock as guide; countersink them on the outside, and put in 3/32 in. iron rivets. They have far less tendency to work loose than copper rivets.

Hammer the rivets well down into the countersinks and smooth off flush with a file. Bolt the frames back to back, with the hornblocks on the outside, then smooth off the rubbing faces of the jaws with a wide flat file, until a piece of ⅝ in. bar, used as a gauge, will fit easily but without shake. Finally, smooth off the lugs flush with the bottom of the frames and erect frames as previously mentioned.

The hornstays are 1¼ in. lengths of ⅜ in. × 1/16 in. mild-steel strip, attached to the lugs by two 6 B.A. screws in each as shown. The axleboxes can be made from castings or bar. If cast, they will be in a stick, and the machining is the same. If a regular milling machine is available, the rebate can be milled with an end-and-face cutter on the arbor, and the stick, or piece of bar, held in a machine vice on the miller table.

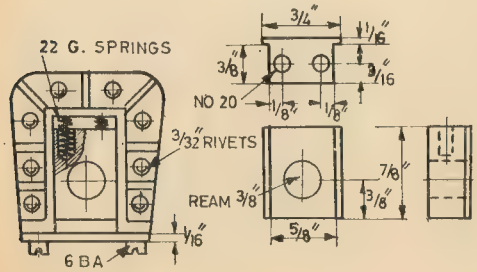
A similar cutter could be used on an arbor between centres in the lathe, and the piece of bar set at the right height in a machine vice—regular or improvised—on the lathe saddle, and traversed under the cutter by turning the cross-slide handle. If a piece of bar (bronze or gunmetal) of 7/16 in. × ¾ in. section is used, it will only need one cut each side, ⅜ in. wide and 1/16 in. deep. A similar piece of bar could be gripped under the slide-rest toolholder, packed up to correct height, and the rebate taken out with a ⅜ in. endmill or slot-drill in the chuck. All these jobs have been fully illustrated in previous serials.

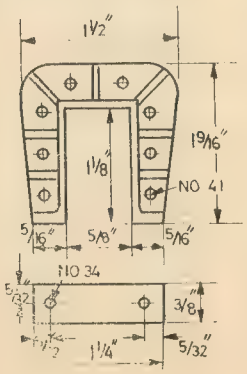
Number the hornblocks on one side 1 to 4, and on the other side 5 to 8. Fit each axlebox to a hornblock and number it to correspond. Then set out the position of the axle holes in each box, Nos 1 to 4, and drill a No 30 hole in each, using either a drilling machine or lathe—not by hand on any account. Clamp No 1 box to No 5 in a machine vice so that they line up exactly, with the flanges on the outside, putting a piece of packing at each side between the flanges and drill No 5, using the hole in No 1 as a guide.

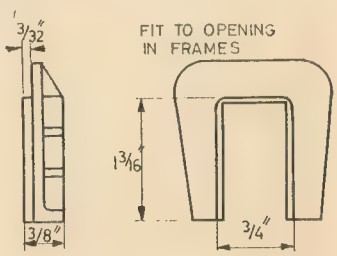
Repeat the operation on Nos 2 and 6, 3 and 7, and 4 and 8. Put them all in position in the frames and poke a piece of ⅛ in. silver-steel rod—or the No 30 drill will do—through each pair. The bit of rod, or the drill, should lie exactly square across the frames. If it does, then all the boxes can be opened out with 23/64 in. drill and reamed ⅜ in. If the drill, or bit of rod doesn't lie square across the frames, correct the hole in the box with a rat-tail file, put a larger drill through, and test again. Spare no pains to get them satisfactory; for if they aren't, you are in for a nice packet of trouble later on.

All that remains is to drill the spring pockets with a No 20 drill to ¼ in. depth. If a 1/16 in. drill is put down each right into the journal hole, the journals can be oiled by dropping a few spots of oil down the spring pocket, which can easily be done from outside the engine. Put the ⅜ in. reamer through again to remove any burring.

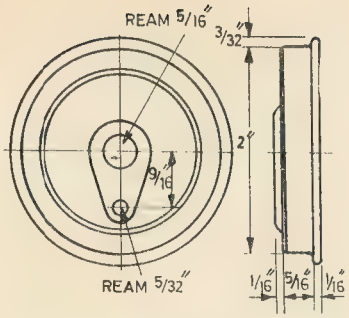
The springs are wound up from







Above and left: Hornblocks and axleboxes



22-gauge tinned steel wire, and should just be starting to compress when the axlebox is at the bottom of the horn-block. Touch both ends of each spring on the side of a fast-running emery-wheel to square them off to length.

WHEELS AND AXLES

The wheels are 2 in. dia. and may be spoked or plain disc, as preferred. If disc wheels are used, drill a $\frac{5}{16}$ in. hole at each side of the pear-shaped boss, about midway between the balance-weight and crankpin. The first and fourth pairs are flanged as usual, but the second and third have no flanges, which allows the engine to traverse sharp curves.

The width of the wheels is sufficient to prevent derailing; my 4-12-2 has no flanges on the two middle pairs of wheels, and they have never run off in all her 30 years' running. The machining of both kinds is as previously described.

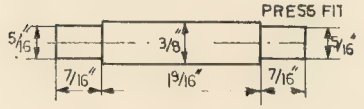
Briefly, chuck in the three-jaw with the back outwards, face off, centre, drill boss 19/64 in. and ream $\frac{5}{16}$ in. Reverse in the chuck, and face boss and rim. Chuck an old wheel casting or other disc of metal a little under 2 in. dia. and face it off, cutting a recess about 1/32 in. deep and about 1 in. dia. in the middle. Centre, drill 11/32 in. and tap $\frac{3}{8}$ in. × 32.

Screw in a piece of $\frac{3}{8}$ in. round steel about $1\frac{1}{4}$ in. long, with $\frac{3}{8}$ in. of $\frac{3}{8}$ in. × 32 thread on the end; this must fit very tightly. Turn down the projecting bit until the wheels will just slide on without shake, then screw the end $\frac{5}{16}$ in. × 26 or 32 and fit a nut. Put each wheel on it, tighten the nut sufficiently to prevent slipping, but not enough to distort, and turn the treads and flanges to within about 1/64 in. of the finished size.

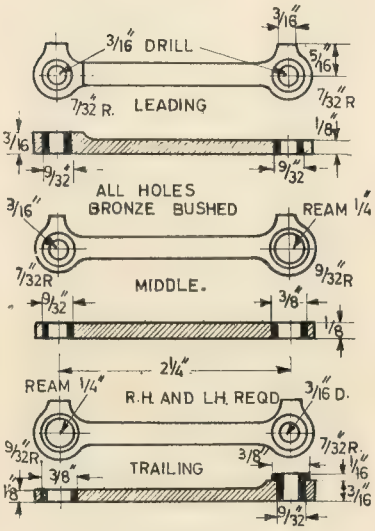
Regrind the tool, and turn one tread to the finished diameter, finishing off the others without shifting the cross-slide. They will then be all exactly alike, which is essential with coupled wheels. The flanges of the first and fourth pairs can be rounded off with a file while still on the peg, without further turning. Finally,

Left: Leading and trailing

Right: Intermediate and driving



Coupled wheels and axles



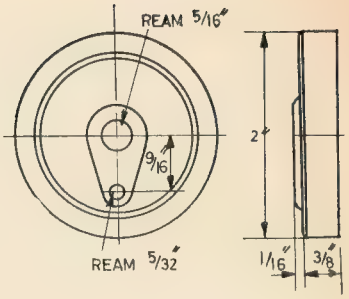
The coupling rods

chuck each wheel in the three-jaw, face outwards, and cut the little rebate between the spokes and rim (representing the joint between wheel-centre and tyre in full size) with a parting-tool set crosswise in the rest.

Drill the crankpin holes in the bosses by jig. On a piece of steel bar about $1\frac{1}{2}$ in. long and $\frac{1}{4}$ in. × $\frac{1}{2}$ in. section, make two centrepops $\frac{9}{16}$ in. apart, and drill them No 24. Open out one with 19/64 in. drill. Chuck a bit of $\frac{5}{16}$ in. round steel in the three-jaw and take a slight skim off it so that it just fits the hole in the wheel boss without shake. Turn down $\frac{1}{4}$ in. of the end to a press fit in the 19/64 in. hole in the jig, part off at $\frac{3}{8}$ in. from the shoulder and press it into the jig.

To use, put this peg in the hole in the wheel boss, then adjust the jig until the No 24 hole in it is central in the narrow part of the boss; clamp it there with a toolmaker's cramp, put the drill down the hole and drill right through the wheel boss. When all are thus drilled, put a 5/32 in. parallel reamer through the lot.

If the three-jaw is true within the usual limit, or if collets are available, the crankpins can be turned from silver steel of finished diameter, and will be



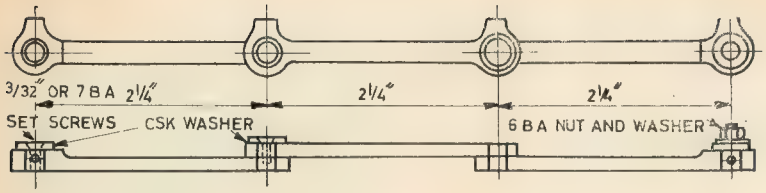
practically wear-resisting; it is wonderful how long the "natural" finish of silver steel lasts. The shanks should be a press fit in the wheel bosses, but not tight enough to split them, which is easily done.

After turning the shanks, the leading and intermediate pins should be parted off to the length shown, reversed in the chuck, centred, drilled No 48 and tapped 3/32 in. or 7 B.A. for the screws holding the countersunk washers in place. These are made from $\frac{3}{8}$ in. rod. Face, centre deeply enough to form the countersink, and part off a $\frac{1}{16}$ in. slice.

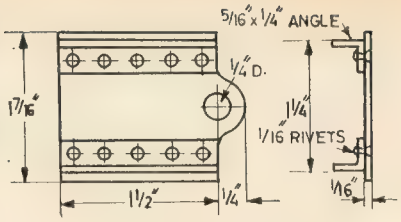
The driving pins have a $\frac{3}{16}$ in. pip $\frac{1}{4}$ in. long on the end to carry the return cranks of the valve gear; after parting off $\frac{3}{4}$ in. from the shoulder of the shank, reverse in the chuck and turn the pip as shown. The trailing pins should be parted off at $\frac{7}{16}$ in. from the shoulder, reversed in the chuck, and the end turned down and screwed 6 B.A., leaving 17/64 in. of "plain" as shown. Squeeze the shanks into the wheels by the aid of the bench vice, and if they go hard take them out and ease very slightly with a fine file; or else—crack!—and you've had it. Incidentally, be sure to put the shortest pins and the screwed pins in the flanged wheels.

The axles can be turned from $\frac{3}{8}$ in. round mild steel (ground variety if possible, but drawn will do) if a collet or true chuck happen to be available. If the chuck is out of truth, turn the axles between centres from a size bigger steel, and observe the same strict caution as before to avoid splitting the wheel bosses by making the wheel seats too tight. A good wheeze for beginners is to chuck a bit of $\frac{3}{8}$ in. rod and turn about $\frac{1}{4}$ in. of it until it is a tight *push* fit in the hole. Note the setting of the "mike" collar on the cross-slide, if it has one, or the position of the handle if it hasn't.

Now turn the handle back half a turn and bring it back again until the collar indicates one division less than it did before. Turn the next $\frac{1}{4}$ in. with this setting, and if it won't push in then that is your setting for a correct



Above: Assembly of the coupling rods



Right: The pony bolster

press fit. If the cross-slide has no graduated collar, the only thing to do is to use your judgment in bringing the handle back for the second cut—but it is quite easy. Turning the handle back and bringing it forward again automatically allows for slack in the nut and screw of the cross-slide; they are sure to have a little.

Press one wheel on each axle, two flanged and two unflanged; the eccentrics for the pump and lubricator have to be fitted before pressing on the others. The pump eccentric is turned from a bit of 1 in. round mild steel (an offcut of shafting does fine) held in the three-jaw. Face the end, then at $\frac{1}{16}$ in. from it turn a groove $\frac{3}{16}$ in. wide and $\frac{1}{16}$ in. deep with a parting-tool. Part off at $\frac{1}{2}$ in. from the end.

The toolmarks will indicate the true centre, and at $\frac{3}{16}$ in. from this make a centrepop. Chuck in the four-jaw with this running truly, open the pop with a centre drill and drill through with a 23/64 in. drill, reaming $\frac{3}{8}$ in. Chuck a stub of $\frac{7}{16}$ in. rod and turn it down for about $\frac{1}{2}$ in. length to a drive fit in the eccentric. Mount the eccentric on it, grooved end first, rechuck and turn down $\frac{3}{16}$ in. of the end to $\frac{5}{8}$ in. dia. then remove it, drill the boss No 44 and tap 6 B.A. for the setscrew. This eccentric is mounted on the driving axle.

The eccentric for driving the lubricator can be turned from a piece of $1\frac{1}{8}$ in. or larger round steel. Chuck, face, turn $\frac{1}{4}$ in. length to $1\frac{1}{16}$ in. dia. and further reduce $\frac{1}{8}$ in. to $\frac{15}{16}$ in. dia. Part off at $\frac{9}{16}$ in. from the end, reverse in chuck, and face off until the flange is a full 1/32 in. thick. At $\frac{3}{16}$ in. from the centre make a centrepop, and follow procedure as detailed. As this eccentric has no side boss, owing to the limited space in which it has to work, drill a No 48 hole in the thickness, and tap it 3/32 in. or 7 B.A. for a grubscrew. This eccentric goes on the leading coupled axle.

To avoid getting mixed up with the wheels of a multi-coupled engine, I always ease the ends of the wheel seats slightly, so that the wheels can be pushed on about $\frac{1}{8}$ in. or so by hand. The axle, with one wheel pressed on, is then inserted through the axlebox on one side, the eccentric put on, and the axle then pushed through the other box—the other wheel then being put on as far as it will go by hand with the crankpins set at right angles as near as possible by eye.

The complete assemblies—wheels, axles and axleboxes—are then removed from the frame, the wheels quartered, and the pressing completed, the lot then being put back. Despite the various gadgets devised for doing the quartering, I always use the method described in previous notes, setting one crankpin vertical to a try-square, and the other to the needle of a scribing block or surface gauge, set at the exact height of the axle centre.

When set, and before pressing the wheels right home, it is a good idea to make up a pair of dummy coupling rods—merely strips of metal with holes in them to fit the crankpins, drilled at the same centres as the axles. Put one of these on each side, and if the wheels all turn freely with them on, the quartering is satisfactory. If there is any binding you can see at a glance which wheel needs correcting and it can be put right before the wheel is pressed right home.

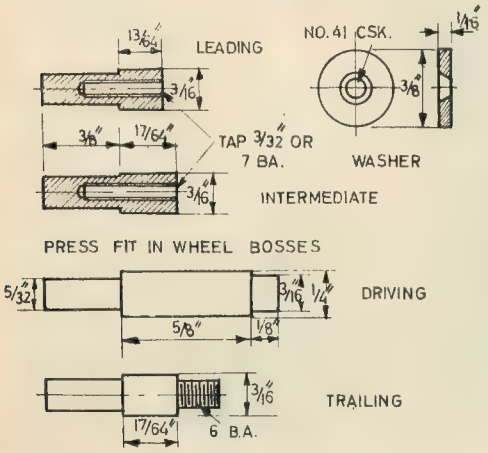
When putting the axleboxes back in the frame don't forget to put the springs in, and also jam a bit of $\frac{1}{8}$ in. square rod between each axlebox and the hornstay to keep the boxes in running position while the "works" are erected.

PONY BOLSTER AND PUMP STAY

The pony bolster can be cast or built up; all the latter needs is a piece of 16-gauge steel cut to the dimensions shown, with a piece of $\frac{5}{16}$ in. × $\frac{1}{16}$ in. angle riveted at each side to form the attachment to frames.

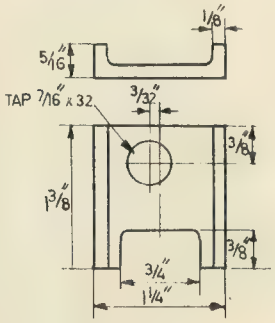
The pump stay can also be cast, or bent up from a piece of 3/32 in. steel or brass, with the hole for the pump barrel drilled and tapped as shown. Note the offset; the pump has to be fitted thus to make room for the eccentric on the leading axle. Cut a gap in the bottom as illustrated to make room for the union on the feed pipe. Getting in the blobs and gadgets on this engine is a bit of a squeeze!

● *Continued on page* 833

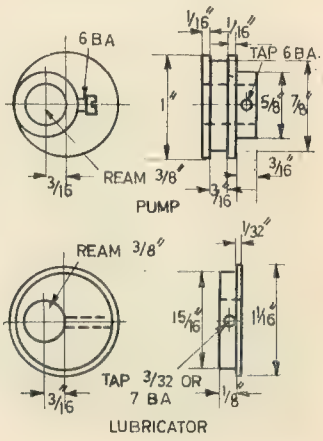


Left: The crankpins

Right: The eccentrics



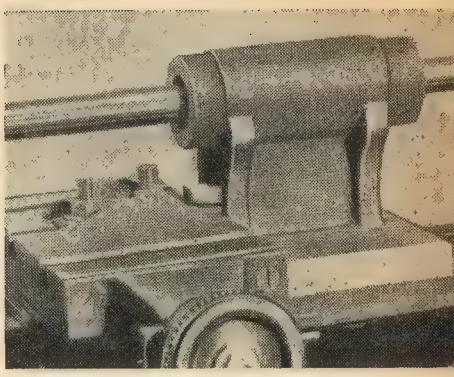
The pump stay



A LEVER-OPERATED TAILSTOCK

for an early 3½ in. Drummond

While he does not claim originality for this construction, J. D. ELAM hopes, nevertheless, that his experience will encourage others to try their hand



Boring tailstock by towing by cross-slide

I COULD with very little trouble have converted the tailstock of my 3½ in. Drummond from screw feed to lever feed. But these conversions more often than not fall into disuse owing to the bother of the change over. How often is a thread (which ought to be cut in the lathe) cut with a die to obviate the changing of fine feed to the particular thread one wants to cut? I would say far too often, I am afraid.

With this in mind I decided to construct an auxiliary one, similar to the one supplied with the lathe, but, of course, without the set-over base. The mandrel for this is 1⅛ in. against the ¾ in. dia. in the original—the reasons for which I shall give later.

Having made patterns and received castings, they were annealed and pickled to remove any embedded sand. Then I machined the base, which was done on my small planer—it could be carried out on a shaper or by chiselling, filing and scraping.

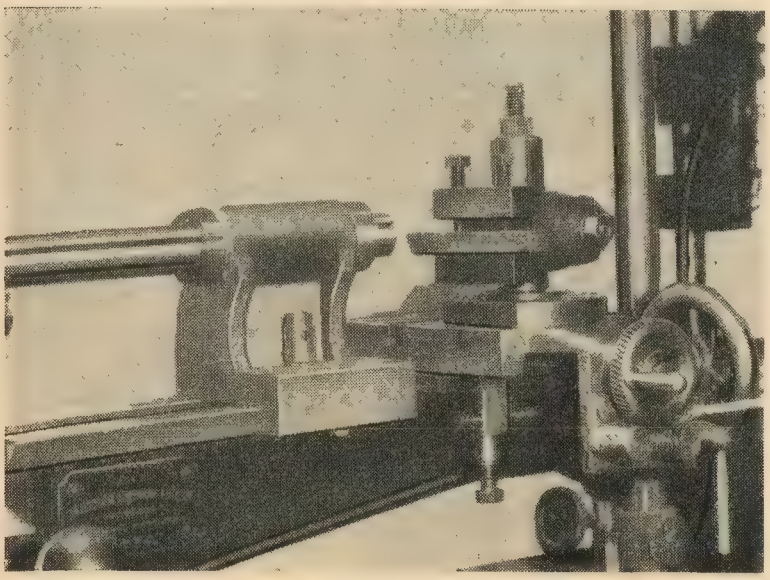
My home-made lathe bed fittings are all constructed with a separate gib, attached by two taper pins well driven in, plus a B.S.F. safety-retaining bolt. You will notice on the base under the barrel a cylindrical drilled fitment. This is attached to an eccentric-ended bolt, which, when turned through a few degrees, clamps the base and gib to the front lathe shear. The rear of the tailstock is clamped to the flats under the back shear and this prevents any distortion of the lathe bed.

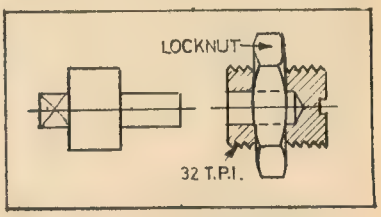
As the barrel had to be bored by boring bar between centres, some method had to be evolved to traverse casting along the bed. I overcame this by fitting a temporary back gib strip, attached by passing a ⅜ in. bolt through the back-clamping hole in the tailstock into a tapped hole in the temporary gib and adjusting to a good sliding fit.

When making the pattern I provided for a small tongue to be cast on front of the tailstock, about ½ in. above the saddle level. This was drilled ¼ in. clearance and, by clamping to the saddle a plate with a ¼ in. pin projecting to engage the hole, the tailstock under construction was towed along the lathe bed—and in due course a perfect sliding fit to the mandrel resulted.

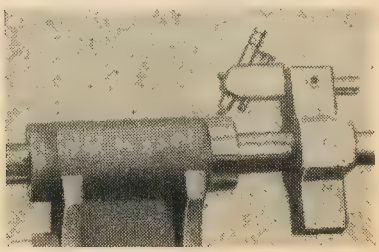
I was greatly helped in this job by using a micrometer head in a boring-bar fitting I had previously made, and so could advance the cutter against the micrometer readings and the telescope gauge-bore recordings.

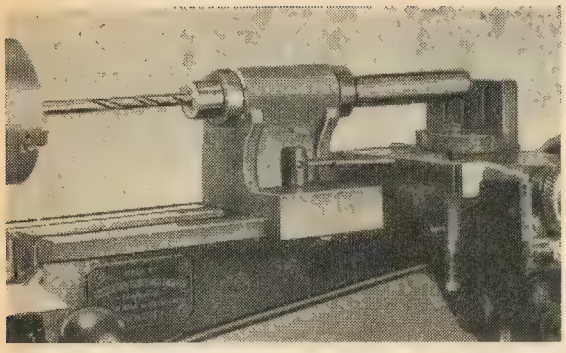
I next had to scheme some method to turn the outside ends of the tailstock barrel for the collar bracket which takes one end of the hand lever and also to turn-finish the front



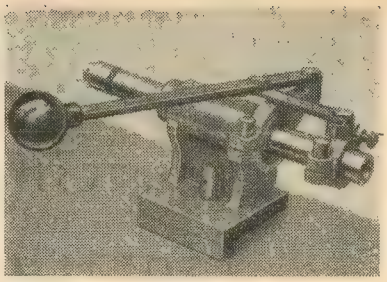


Above: *The adjustable key*
Left: *End of the mandrel being faced*
Below: *Shoulders being machined by the special attachment*

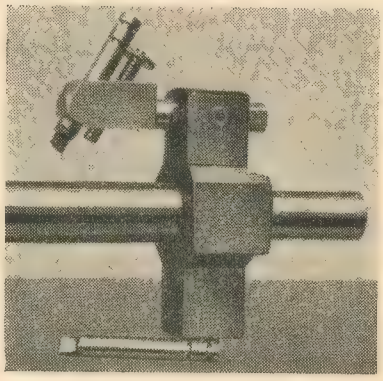




Left: The mandrel being drilled. Feed by angle-plate attached to the cross-slide



Right: The completed tailstock



Close-up of the special attachment

end for the sake of appearance.

You will see from my pictures that the tool evolved consists of a casting with a sliding arm, to the end of which and set at an angle is an adjustable tool holder. The adjustment is obtained by a 40 t.p.i. feedscrew set parallel to the tool holder, the disc head of which engages with an annular recess in the tool holder. This disc head is marked with 25 divisions, which with a screw gives a feed of a thou for a movement of one division. All movable fittings are fixed by Allen screws, acting on flats machined on fittings.

The actual cutting tools are tungsten carbide tips silver soldered on to $\frac{1}{4}$ in. bits, which are, in turn, soft soldered into the tool holder. I had, of course, to make two tool holders—one each for right and left turning. The result came fully up to my expectation.

The next job was to cut the keyway the whole length of mandrel and fit the key to the barrel.

The key is in two parts, made from $\frac{5}{16}$ in. mild steel. The key is milled or filed a sliding fit in the keyway; the whole diameter behind this is retained for about $\frac{1}{4}$ in., then is reduced to $\frac{1}{8}$ in. dia. $\times$ $\frac{1}{4}$ in. long. This small end is housed in a blind hole in a stud threaded on its outside 32 t.p.i. and fitted with a locknut, and is fitted into the barrel on the rear side in a convenient position.

This method of construction allows for a fairly wide key instead of screwing in a solid key with, say, a $\frac{1}{8}$ in. dia. pin. The mandrel's clamping screw with its brass pad was next prepared and fitted in its usual position. The mandrel was then replaced in the tailstock, which acted as a perfect steady and the mandrel ends were faced and centred, the drive being by s.c. chuck.

Drilling through a 11 in. solid mandrel caused me some apprehension. But I accomplished this by drilling from each end in turn, first with a W drill, followed by a long 9.75 mm. drill. As I could not use my original tailstock to feed the mandrel, owing to the lathe bed's lack of length, I bolted an angle plate to the saddle to perform this purpose. It will not be difficult for one to imagine how pleased I was when each drilled hole on meeting coincided perfectly.

The key was once more removed and the mandrel, again being driven by s.c. chuck, the two tapers were bored out—one end No 1 the other No 2 Morse.

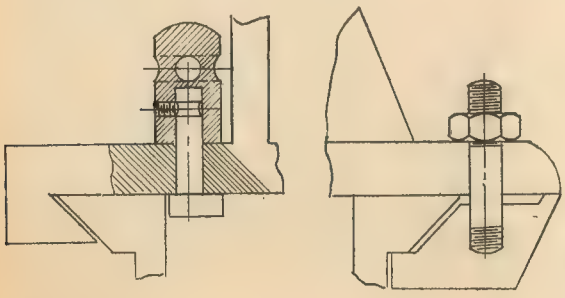
The mandrel, being instantly reversible, allows for the choice of No 1 or No 2 Morse shanks, which proves very convenient when one wants to use a larger drill, reamer, etc. than is made with No 1 taper.

The split collared bracket for attaching the end of the hand lever and the one clamping mandrel, were now finished and fitted with clamping bolts. The one clamped to the mandrel has on its offside a lug through which passes a 3 in. $\times$ $\frac{5}{16}$ in. B.S.F. bolt which can be adjusted to form a stop for depth drilling, etc.

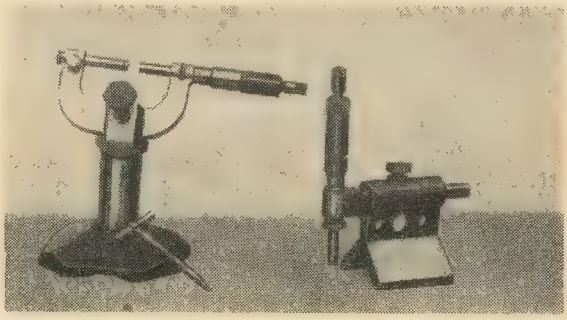
It will be apparent that since the bracket on the tailstock body swivels on it, the lever feed can be used in any position. My main lever is some 10 in. long, the link anchorage is $2\frac{1}{2}$ in. from the fulcrum stud and the link $3\frac{1}{2}$ in. long.

Such jobs as these afford unusual practice for the homeworker, give pride in their successful accomplishment, besides enhancing the value of equipment by many pounds. ▣

Front eccentric clamp and rear clamp



Aids to accurate boring



EXPERT'S WORKSHOP

A cutting oil feed for the lathe

By DUPLEX

AFTER the oil spray gun described in the previous article has been completed, the next step is to make a suitable mounting for attaching the appliance to the lathe cross-slide.

The double-purpose clamp *G* serves to grip the bar *A* of the attachment and at the same time secures it to the pillar *J* of the lathe mounting.

THE MOUNTING CLAMP

The body *Ga* of the clamp is made from a length of $\frac{7}{16}$ in. square mild steel, and to facilitate the machining, a piece of this material several inches in length is first marked-out and then cross-drilled in two directions in accordance with the details given in Fig. 8. Before the body part is cut off to length, the work is gripped in the lathe toolpost to enable the end to be slit with a circular metal saw mounted on an arbor between centres.

This slitting can quite well be carried out with a hand hacksaw, but the machining operation is, perhaps, quicker and it ensures that the work is accurately done. If the workshop is equipped with the pair of motor-driven grinding heads described in previous articles, the two ends of the body can be quickly and accurately rounded to a radius of 7/32 in.

The chief difficulty in grinding small parts to shape in this way is that they quickly become too hot to hold, but there is no reason why they should not be cooled from time to time by dipping in water; for, here, there is no danger of surface cracks forming as would be liable to happen with lathe tools and twist drills made of hardened carbon steel.

It should, however, be noted that it is essential to use the correct type of abrasive wheel for this work, since an unsuitable wheel may rapidly become loaded with metal particles and cease to grind effectively.

The draw spindle *Gb* is turned to the dimensions given in Fig. 9 and both parts are cross-drilled after the sleeve *Gc* has been machined to a close fit and assembled in place.

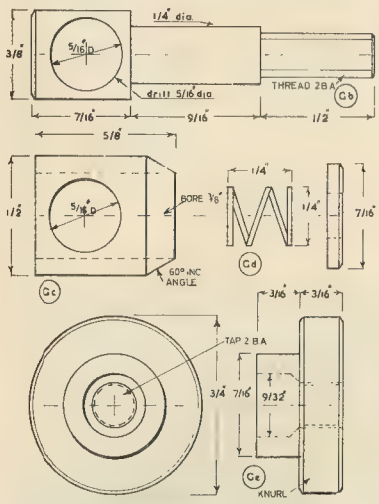


Fig. 9: (Gb) *the draw spindle of the mounting clamp*; (Gc) *the sleeve*; (Gd) *the compression spring*; (Ge) *the knurled nut*

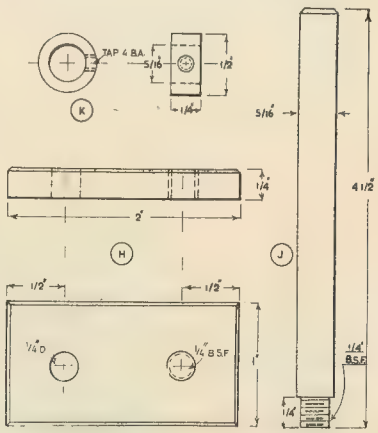


Fig. 10: (H) *the base of the saddle mounting*; (J) *the pillar*; (K) *height adjusting collar*

The jig described in a previous article will be found useful for the drilling operation; for not only will it ensure that the bore is exactly on the diameter line, but it also serves to clamp the parts together so that they cannot shift during drilling.

If the work is drilled when gripped in a machine vice, and the drilling centre located by eye, great care must be taken to avoid drilling the parts off-centre, for this would weaken the rather slender head which at its sides is only 1/32 in. thick. The coned end of the sleeve fits into the corresponding coned recess formed in the body of the clamp and, by this means, the assembled parts are accurately located.

After the knurled finger-nut has been machined, and the components of the clamp assembled, it should be found that, on tightening the nut, pieces of $\frac{1}{4}$ in. and $\frac{5}{16}$ in. dia. rod are simultaneously firmly gripped. The small spring *Gd* fits into the 9/32 in. dia. recess drilled in the finger-nut and its purpose is to maintain frictional contact while adjustment of the position of the spray gun is being made.

In the present instance, the gun has been mounted on the lathe cross-slide as illustrated in Fig. 2 of the previous article; in this way a wide range of movement is obtained and, in addition, the attachment can be quickly removed or secured in place. Alternatively, the spray gun can be clamped to the lathe toolpost or preferably to the back toolpost where it will be less in the way during machining operations.

CROSS-SLIDE MOUNTING

The base *H* of the mounting is made from 1 in. × $\frac{1}{4}$ in. mild-steel bar which is drilled and tapped to accommodate the pillar *J* and the T-bolt *L* for securing the attachment to the lathe saddle. The pillar can be made from a length of bright mild-steel stock and, to ensure that the clamp slides smoothly, it is advisable to lap the rod lightly to remove surface irregularities.

The small collar *K*, which is secured to the pillar with a 4 B.A. grubscrew, enables the gun to be swung into position for spraying the work without losing height. The T-bolt illustrated in Fig. 11 is suitable for mounting the attachment on the cross-slide of the Drummond lathe and is machined from $\frac{3}{4}$ in. dia. mild-steel rod to a close fit in the saddle T-slots. The knurled fingernut *L* has been made with a long skirt for ease of manipulation.

Because of the large size of the Drummond boring table, the spray gun can be mounted and brought into use with the topslide and the back toolpost still in place; this has the

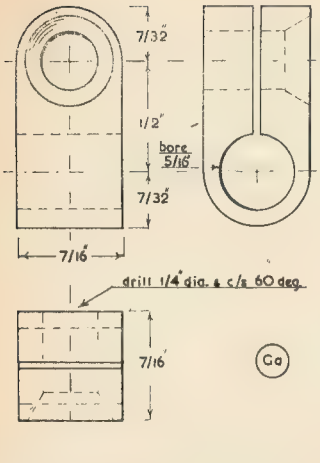


Fig. 8: *Body of mounting clamp*

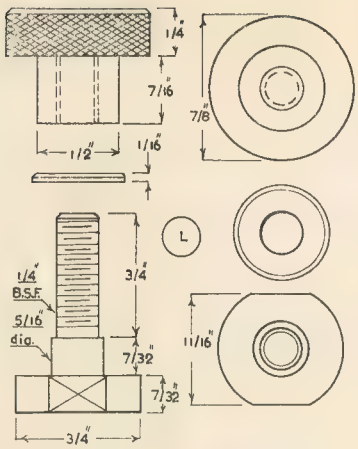


Fig. 11: *The saddle T-bolt*

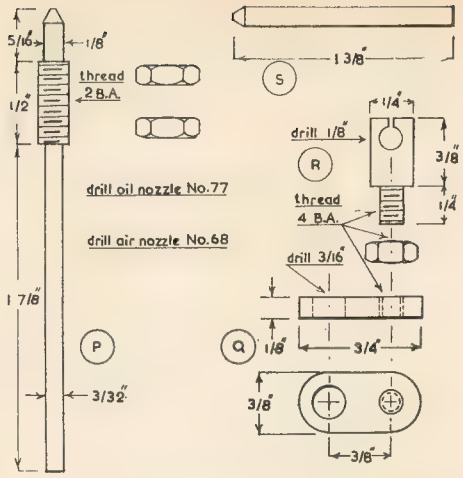


Fig. 14: *Spray gun components.* (P) *the oil tube and nozzle*; (Q) *mounting plate*; (R) *the pillar*; (S) *the air delivery tube*

advantage that the oil spray is available for parting-off from the back toolpost to speed the machining and improve the work finish.

When not required for use the gun is detached from the cross-slide so that, as shown in Fig. 12, the complete spraying unit can be conveniently kept out of harm's way when slung in a pair of wire hooks from the cross bar of the lathe overhead.

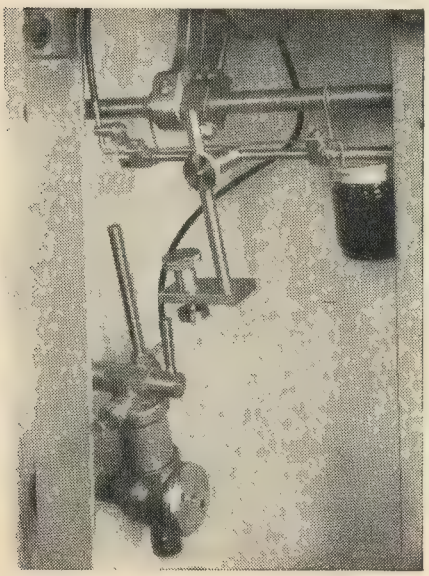
This illustration also shows the small belt-driven compressor, mounted on one of the uprights of the overhead gear and connected to the gun by a length of plastic tubing. The construction of this compressor will be described in the next article, together with suggestions for spraying the cutting oil to the best advantage.

A MINIATURE SPRAY GUN

The spray gun of 1 oz. capacity illustrated in Fig. 13 was made for painting small instrument parts with the optical black lacquer manufactured by Cannings, of Birmingham, under the name Ebonide. Although this pigment can be applied with a soft brush, a better finish is usually obtained by spraying, but for this purpose the lacquer may have to be diluted with the special thinner if the pressure of the air supply to the gun is insufficient.

The construction of the spraying head is essentially similar to that of the previous example. As shown in Fig. 14, the oil pipe *P* consists of an upper threaded part, forming the nozzle, into which is sweated a length of 3/32 in. dia. copper tube. This component is furnished with two 2 B.A. nuts that serve to secure it in place in the mounting plate *Q* and also to clamp together the drip tray and the plastic cap of the container on which the parts are mounted. The pillar *R* is screwed into the plate *Q* where it is secured by a lock-nut.

The pillar is cross-drilled to carry the air tube *S*, and by slitting the upper end of the pillar and then compressing it in the vice the resulting frictional contact will enable the projection of the nozzle to be exactly adjusted. When fitting the air tube, its nozzle should be set in line with but slightly short of and below the tip of the oil pipe nozzle before finally locking the pillar in place. ■



Left, Fig. 12: *Housing the spraying unit when not in use*

Right, Fig. 13: *The miniature spray gun*

RUSTON 52266

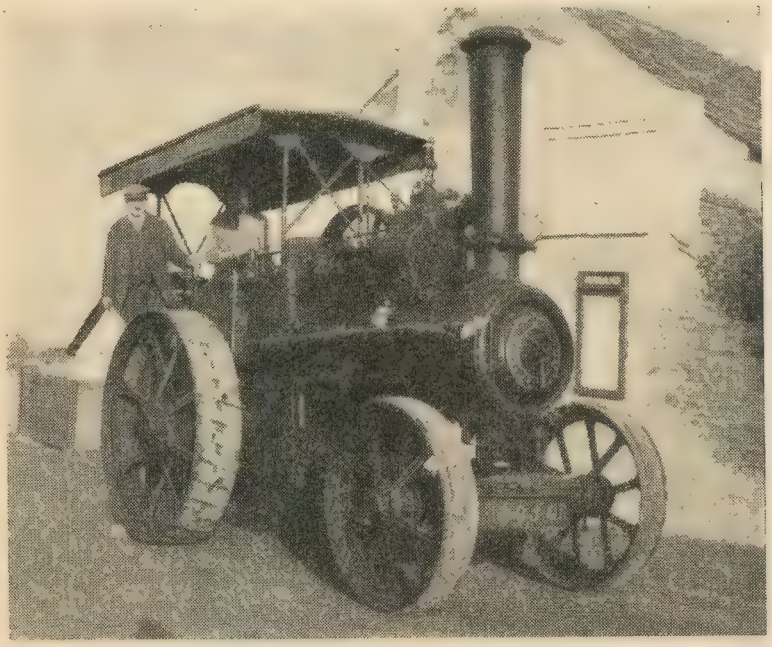
D. W. SMITH tells how a traction engine was purchased for preservation and restored to working order

RUSTON 52266 is a 5 h.p. general purpose traction engine. She is a four-shaft machine with two speeds, is unsprung and was built in 1918 for the War Department. She was sold unused in 1920 to Charles James, of Penypark, Clifford, Herefordshire, who used her up to 1950 for threshing with a 4 ft Ruston threshing machine.

From 1950 to 1954 the engine was idle and was then purchased for preservation. An examination was made and the following items were discovered. The firebox was thin on crown around fusible plug; several stays were broken on the flywheel side of firebox; boiler tubes needed renewal; the smokebox door and portion of smokebox flange ring were rusted away; and water tank leaked from a small hole underneath. This last fault was discovered after completely filling the tank by bucket from a well 20 yards away !

These defects must seem formidable to readers, as indeed they did to us, but we did the various jobs in order of importance and found each task was often easier than it first appeared. Looking back now, one of the worst tasks was the removal of the old and wasted footplate, this having to be done with a chisel with the constant chance of gashing one's hands on the old rusted metal.

To compensate for the defects we found that the general condition of the engine was good; motion work, bearings, wheel strakes, and steering gear were all in good order. All fittings were complete and several spares for the engine were made available by the generosity of Mr James who also had the instruction book and illustrated spare parts catalogue.



The traction engine at the start of its journey from Penypark to Bucknell. Charles James the former owner (wearing cap) is on the footplate

The renovation was commenced at Mr James' premises where we fitted the new tubes and moved the fusible plug, a new door was also fitted to the smokebox before starting the homeward journey.

After these jobs were completed the engine was steamed up and tested on the road. She was driven about a mile and a half on this occasion and found to be sound and roadworthy.

A few days later 52266 travelled under her own steam to Mr R. M. Woolley's yard at Bucknell, Shropshire, a distance of some 32 miles which was covered in about 11 hours. The photograph shows the engine at the start of its journey, with her former owner on the footplate.

At Bucknell the broken firebox stays were removed and new ones fitted, a new footplate was bolted in place and numerous small jobs undertaken. During winter months work was carried on by the light of a pressure lamp standing on an upturned oil drum, this giving ample illumination for most jobs.

The engine is now nearly restored, there only remaining some painting jobs to do. These will be completed when the weather is suitable and then it is hoped that the Ruston will represent, as near as possible, a typical agricultural engine of the early 20th century.

It is at present stabled near Craven Arms at the premises of Messrs W. A. Bishop, of Burley, who are themselves operators of steam vehicles and enthusiastic engine owners.

I would like to take this opportunity of thanking Messrs Bishop for their help and generosity which are at all times so readily given.

Many thanks are due to Mr and Mrs James for their very kind hospitality while we were at Penypark. ■

HISTORICAL LOCO MODELS

Locomotives Worth Modelling, by F. C. Hambleton, gives descriptions of many famous engines of the pre-grouping period including: the old Midland No 1447; London and South Western No 591; London Chatham and Dover No 145; the famous Great Northern Number One; and the Manchester, Sheffield and Lincolnshire No 694.

Lavishly illustrated throughout its 176 pages with detailed drawings it is obtainable from Percival Marshall and Co. Ltd, 19-20 Noel Street, London, W.1, price 10s. 6d., postage 8d. (U.S.A. and Canada $2.50).

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

'PIXIE'

SIR,—May I add my support to those who suggest that L.B.S.C. might next describe a London and North Western Experiment or Prince of Wales 4-6-0? Both of these were good-looking classes; and in L.B.S.C.'s hands their faults of design could be eliminated, so that readers of MODEL ENGINEER would in the end get the best of both worlds.

I am very interested in *Pixie*, the 2-2-2 for the children. L.B.S.C. suggests that an alternative version having slip eccentrics might be described. Could this be given and could this "de luxe" edition have springing to the engine wheels, so as to ensure enough adhesion on the drivers?

Hutton, Essex. H. H. ROBINSON.

ENJOYABLE NONSENSE

SIR,—Some weeks ago you published a "nonsense" letter from K. R. D. Tucker in which he deliberately punned and misused some of the shipbuilder's jargon. In fairness to Mr Tucker I feel that a view opposite to that of Mr Basil Mace (Postbag, May 9) ought to be expressed.

Perhaps the indignation Mr Mace feels for the corruption of his technical terms can be understood and forgiven on the grounds of the love he feels for his hobby. Mr Mace is, of course, entitled to his opinion.

For my part, I thank Mr Tucker for his "childish nonsense" and for the time and trouble he took in concocting it. May both criticism and commendation stimulate him to further efforts.

Birmingham 8. W. DUXBURY.

DINGHY BOILER

SIR,—Reference to "Powering a dinghy" [Readers' Queries, May 9], I would suggest that the boiler recommended in the reply is utterly unsuitable for the purpose. A boiler 2 ft dia. × 3 ft high, *exclusive of firebox*, is far larger than is needed for the purpose and its height above would make any normal dinghy unstable.

Incidentally, the querist has the engine dimensions wrong: the Stuart 5A is 2¼ in. *bore* × 2 in. stroke.

If the boiler is to be coal-fired, a vertical multitubular boiler 14 in. × 24 in. high (including firebox) with internal firebox 12 in. high and 61 ⅝ in. tubes at about 1 in. pitch would provide ample heating surface (roughly 3 sq. ft in the firebox and 10 sq. ft in the tubes) to steam the Stuart 5A at full power.

Made from 3/16 in. plate it should be suitable for 100 p.s.i. working pressure, with a reasonable margin for deterioration.

If wanted for oil-firing, then a plain drum type 14 in. dia. and 14 in. high, with about 80 ⅝ in. tubes spaced at say ⅞ in. would fill the bill; in this case, of course, the firebox is additional and should be heavily lined with fireclay. A small Lune Valley type of burner would be ideal for liquid fuel.

As a pointer to boiler capacity the 10 h.p. Stanley boiler was around 18 in. dia. × 14 in. or 15 in. high and provided ample steam at 500 p.s.i. for a pair of high-pressure cylinders 3¼ in. × 4¼ in. bore and stroke.

Rustington, W. Sussex. K. N. HARRIS.

WATERWHEEL

SIR,—A gigantic waterwheel, constructed by John Casement in 1854, is regarded as one of the marvels of the Isle of Man. Some idea of its size can be judged from the measurements: circumference 227 ft, dia. 72½ ft, breadth 6 ft.

It worked as an automatic pump and was capable of raising 250 gallons per minute from a depth of 1,200 ft. The horizontal pumping rods, supported on wheels running on rails, are carried from the wheel on a long arched viaduct to the main shaft of the lead mine, a distance of 600 ft! The platform, which can be reached by a spiral staircase of 95 steps, is 75 ft from the ground.

The Laxey Mines, now closed, produced lead, zinc, silver and copper. Between 1831 and 1884 ore to the value of £2,068,000 was won from the workings.

The big wheel is locally dubbed Lady Isabella.

Darlington, Durham. J. DENTON ROBINSON.

THE "CAMPANIA"

SIR,—What occasions this letter is H. E. Hughes' article on the *Campania*. I crossed home on her, sailing from Liverpool on 15 August 1914, still under Cunard colours. Father said she was leased to the Anchor Line, but was recalled to take home passengers who had booked on the *Aquitania*, which went direcly into Royal service.

May this not have been her last western crossing? She carried a

The giant waterwheel on the Isle of Man

total of 700 passengers. I remember she was crowded, but that was partly due to her very large boilers and engine room ! We spoke the cruiser H.M.S. *Essex* off Halifax on the Thursday.

Other facts of our trip might be of interest. On June 17 we rented a four-cylinder Minerva from International Autotravel Co. and, driven by their man, J. E. Sage, we toured England, Wales and Scotland for 53 days, covering 3,260 miles.

Wish now I could remember the steam launch we hired on Windermere for three hours at 6s. per hour ! The only breakdown occurred there, a con-rod bearing burned out. Our longest day's run was from Leamington to Bettws-y-Coed, 157 miles, with rain too. We took a ten-mile detour to Wrexham to visit the grave of Elihu Yale.

Father remarked on the good roads and beautiful scenery.

Do any Northern readers have any information on the steam paddle tug I saw on the Tyne two years ago ? *Reliant* was her name.

I am building a Neptune but I cannot disclose my ultimate object for fear that rascal Oxley will steal my idea before next Christmas. The security watch at " Emerson Iron Works " has been doubled since we learned he may have departed England in a balloon recently, or did he smuggle out on the *Mayflower II* ?

GILBERT G. EMERSON.

Upper Montclair, N.J.

HORIZONTAL ENGINE

SIR,—I am interested in jig boring but I have not been able to get a book on the subject. Could you please suggest a suitable publication ?

About six months ago I decided to make a horizontal type steam-engine. As I didn't know of any published plans, and never thought there might be some in MODEL ENGINEER, I designed one myself. I have enclosed a rough sketch, as I think it is comparable with the Perseus for simplicity, the valve merely being $\frac{1}{4}$ in. dia. silver steel, grooved, milled and lapped into bore.

Castleford, Yorks. W. GREEN.

Mr Westbury writes: I regret that I do not know of any book on jig boring at present available, but you may possibly be able to obtain some further information on the subject from the Machinery Publishing Co. Ltd, National House, West Street, Brighton 1.

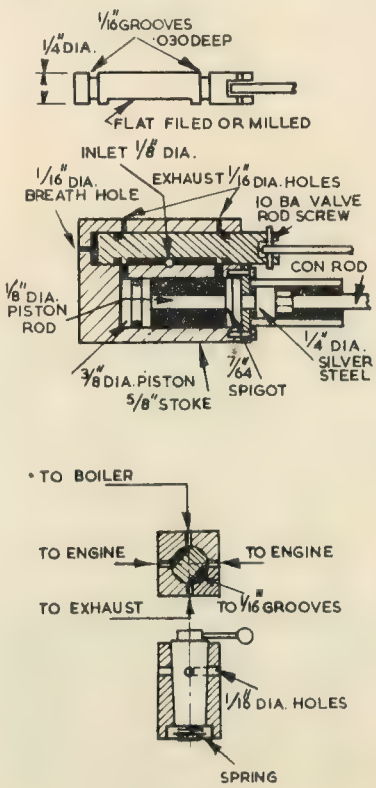
The type of steam-engine outlined in your sketch is quite a practicable one and, as a matter of fact, many small engines are made which utilise piston valves generally similar in principle to the one shown, though this could be improved in detail in cases where it is necessary to get the best efficiency from the cylinder.

The reversing valve shown in your sketch is also quite practicable and in an engine having a piston valve without any lap or lead, direct reversing by this method has often been used in full-size practice. It does not, however, enable the valve gear to be timed to get the maximum engine efficiency and economy.

NARROW-GAUGE MODEL

SIR,—I am still unrepentant. Let us take *Britannia* as the largest type of engine in $\frac{3}{4}$ in. scale and compare it with *Susie M*, which is rather large for a narrow-gauge engine.

I regret that I cannot give exact dimensions as I have lent my notes and drawings to another would-be constructor. Her frames are $\frac{1}{8}$ in. thick, $3\frac{1}{2}$ in. deep and about 20 in. long—smaller and simpler than *Britannia*. Her boiler has a plain square inner firebox and a round topped outer box.



Mr Green's drawing of a piston valve for a horizontal steam-engine

I have just looked up the drawings for *Britannia's* boiler, with its sloping back and front plates, to say nothing of a combustion chamber with cross-tubes. The narrow-gauge boiler is smaller and easier to make.

Wheels are plain disc type and only $3\frac{1}{2}$ in. dia. There are no hornstays, but just plain pieces of steel angle riveted to the frames, just as in the prototype. It should be noted that the frames of *Prince* only extend back as far as the front of the firebox.

No, sir, a narrow-gauge engine is simpler and cheaper to build, and as powerful as a large standard-gauge job in the smaller scale. You also have a decent size reverse lever, handy knobs on valves, a firehole door through which you can easily hurl fuel while running and, in my case, a whistle in the proper place, and one which does not collect condensate because it keeps hot. Neither does it emit steam from underneath when it is used.

May I point out that my workbench, although in the kitchen, is a proper one and I am at present engaged in constructing a $3\frac{1}{2}$ in. gauge version of one of the Vale of Rheidol 2-6-2 tank engines on it ?

As regards cost, it depends where materials are purchased. Most of my steel came from the local blacksmith, as did the steel angle. Copper tube for plumbing, and the pressure-gauge, came from the nearest carbreaker's yard, where much useful material can often be found. Castings from my own patterns, cast locally, cost half that charged by the usual model maker's suppliers.

I have been invited to run this engine again at the Model Engineer Exhibition this year, and I should be delighted to demonstrate personally to Mr Maskelyne the simplicity of construction of this engine, or one similar, when compared with a standard-gauge locomotive of similar performance.

London, N.7. M. EDWIN MOON.

J.N.M. comments: I think Mr Moon is rather beside the point. What he says in this letter is, of course, perfectly correct; and I quite agree with him, except that neither BRITANNIA *nor* SUSIE M *is the kind of job that I would recommend to anyone with only a " kitchen table " workshop.*

DESIGN FOR SUPERHET

SIR,—I read with great interest the articles by R. H. F. Curwen on the radio-controlled power boat *Vanessa*.

In the issue for April 25 Mr Curwen stated that last season he used a four-valve superhet receiver designed by

It is a pity that the vivid red wheels and blue boiler of this handsome engine, clearly shown in Mr Graves' colour print, cannot be reproduced here

D. McQue. Can you give me any information on this receiver?

I would like a circuit diagram with a list and size of components and also, if possible, the approximate position of the main components, the positioning of which I believe is very critical in a superhet receiver.

R.A.F., Gibraltar. KEITH HIGHLEY.

U.S. TRACTION ENGINE

SIR,—The picture printed above shows my 1914 8½ in. × 10 in. Frick Eclipse traction engine which has been completely restored. It is steamed up occasionally to saw wood for the edification of onlookers. The cleats preclude its operation on the highways.

May I take this belated opportunity to compliment you on the excellence of the subject matter and format of MODEL ENGINEER. It would be deplorable if the emphasis on live steam were sacrificed for the questionable interest of quasi-engineering subjects of no historic value.

Short Hills, N.J., U.S.A. W. LEE GRAVES.

CREWE MUSEUM

SIR,—According to the R.C.T.S. publication *Locomotives of the G.W.R.*, the last sandwich-framed 0-6-0 to run on the Great Western was No 316, one of three built at Wolverhampton in 1890/1 to a much earlier design. No 316 was withdrawn in November 1927.

In reply to Mr R. Taylor's letter, there is one Crewe Works narrow-gauge locomotive preserved in the paintshop. This is not, I believe, one of those mentioned; it is named *Pet*.

It may surprise some of your readers who have not been there to know that Crewe paintshop has quite a little museum. On the occasion of my last visit there were, in addition to *Pet*, *Hardwicke* and *Cornwall*, the *Lion*, a Wolverton 0-6-0 saddle tank repainted in original colours and presented by Kynoch's, a Midland compound and a tramway engine from Wigan colliery (both awaiting restoration) and a full-size wooden model of the *Rocket*.

Sheldon, Birmingham 26. J. H. BALLENY.

ARTFUL DODGE

SIR,—Perhaps Gerard I. Kingham [Postbag, May 16] would be interested to hear of an artful dodge frequently used both officially and unofficially to tighten a ballrace in an alloy housing. While not strictly good practice, I suppose, it is harmless, and it works!

If the housing can be removed from the bulk of the structure, so much the better. Remove the ballrace and chuck the housing truly with race bore outwards. Mount a fairly fine cross-knurl wheel on a peg facing the chuck and enter in the bore; with the job running slowly, advance the knurl into cut, slightly knurling the bore.

After a few moments, withdraw the knurl and try the race—the knurl will have raised the metal sufficiently to again grip the race securely. If not, repeat the process until it has.

This tip will be familiar to all old hands, I am sure, but I trust it will be of use to some.

DODGER.

ZOE . . .

continued from page 825

COUPLING RODS

Each coupling rod is made in three "self-contained" sections; there are no knuckle joints to worry about. The whole bunch can be made from $\frac{5}{8}$ in. × $\frac{3}{16}$ in. mild steel by either milling or sawing and filing, as described for other engines in these notes. But as only the extreme ends have bosses $\frac{3}{16}$ in. thick, there is an easier way, utilising rod only $\frac{1}{8}$ in. thick. Rough out the rods, and then before finishing braze a thickening piece of $\frac{1}{16}$ in. steel on the end bosses. When filed up, it would need a mighty sharp eye to spot the joint, and it does not affect the efficiency in the slightest.

All the holes are bronze-bushed as shown, and only the trailing bush is flanged. The leading and intermediate bosses are kept in place by countersunk washers with a setscrew in the tapped hole in the pin; the trailing boss has a nut and washer. The driving bosses are kept in place by the big-end of the connecting rod, to be described in due course.

Note when fitting, only the driving bosses should be an exact fit on the pin. If the others are too close a fit, there will be binding when the engine is on the road. Full-size engines have at least $\frac{1}{16}$ in. slack when new to allow for running through crossings, etc., and this accounts for the ringing when running with steam off.

The assembly and erection are shown in the drawing and need no detailing, but there is one variation which could be adopted if desired. Instead of separate bushes pressed into the bosses on the intermediate and driving crankpins, the bosses could be drilled and reamed to the outside diameter of the bushes, and single floating bushes ¼ in. long, fitted to each pin, the pair of bosses then being placed over the bush. This would make replacement very easy when the bushes eventually need renewal.

● *To be continued*

Period Ship Modelling by R. K. Battson. 3s. 6d.

Construction notes with sixty-five diagrams on the making of a model Elizabethan galleon. This book is primarily for those who, having made a start on this fascinating hobby, wish to acquire greater skill and knowledge. The pitfalls that await the beginner are numerous, but this book will help the modeller to avoid or surmount them.

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W.1.

Mains switchboard

I have made a small mains switchboard (240 v. 50 cycles) and, as I wish to completely disconnect the cable, I am faced with having to make a mains plug and socket in reverse. I find the price of ebonite (1s. 6d. per 1 in.) too dear and, as the board is good well-seasoned teak, I wondered if you would consider it satisfactory to put the pins straight into it.—E.C., Liverpool.

▲ *There are several kinds of plastic materials, including laminated fibre or fabric-based Bakelite compositions, such as Tufnol or Paxolin which would be equal to ebonite in insulating qualities, but nearly all these materials are expensive. Teak switchboards have been used, but to avoid the possibility of deterioration by absorption of moisture it is generally considered necessary to impregnate them with an insulating varnish, and this demands a special process.*

Generally speaking, modern practice in switchboard or instrument panel work favours the use of relatively small insulating bushes or inserts rather than mounting components straight on the board itself. This would enable practically any material to be used for the switchboard and the bushes and inserts would be relatively inexpensive. Mica or Micanite is usually recommended for insulators of this type.

Fitting twin screws

In the past I have constructed several model liners (bread-and-butter system), these all being single-screw propulsion.

I now propose to build a twin-screw model, but am confronted with the procedure I should adopt for the two propeller shaft bossings. Are these carved during the shaping of the hull or are they added after the hull is finished as separate attachments?—P.A.C., London, S.W.12.

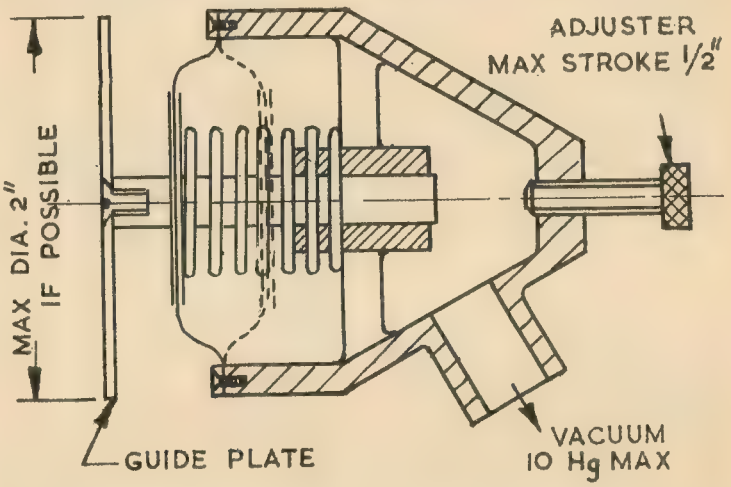
▲ *This question depends very largely on the particular type of hull. In many liners, the shape of the hull is so arranged as to give fine fairing contours in the vicinity of the propeller shafts, and in such cases readers would be advised to form these fairings in the actual shaping of the hull, rather than attempting to attach them afterwards.*

In some types of hulls, however, the shafts are carried in extended stern tubes with little or no fairing; in these instances no allowance need be made in the shape of the hull itself.

Blade operation

I wish to operate a reciprocating blade by some sort of pneumatic motor and wonder whether the type of thing that I require is available commercially or whether it will have to be specially made. I enclose a sketch of the type of thing that I envisage.

The blade is only a guide and the maximum external force on it would be about ¼ oz.; thus the only real work to be done lies in the movement of the plate itself. The frequency of operations would not be more than two cycles per second. The overall length is unimportant, but the outside diameter should not exceed 2 in.



The maximum vacuum available is 10 in. of Mercury but it would be of advantage if the mechanism would function at 8 in. Maximum stroke required is about ½ in.—H.N.U., Altrincham, Cheshire.

▲ *No device of this nature is manufactured for this purpose. The arrangement suggested in your sketch would be capable of providing the necessary motive power, but it would need some form of valve gear to apply the vacuum alternately and admit air to the vacuum chamber on the return stroke.*

It would be possible to apply the same type of valve gear as is used on the suction-operated windscreen wipers which, at one time, were very popular on cars in forming the entire mechanism, and this type of device could probably be adapted, as it works on a relatively low vacuum and could be adjusted to provide the necessary frequency of operation.

Boiler making

I want to make a boiler which would be capable of driving a 12 ft dinghy at about five knots. For an engine I had in mind the Stuart Turner No 5a of 2½ in. bore × 2 in. stroke. You have already stated that this engine would require a boiler of some 3 ft × 2 ft to give easy steaming.

For a pressure of 100 p.s.i. I should want to know the best type of construction, thickness of plate—copper advisable?—and size of tubes and their number.—T.W.B., Lymington, Hants.

▲ *For the construction of a boiler suitable for producing a pressure of 100 lb. and driving an engine of 2½ in. bore × 2 in. stroke, the thickness of plate for a boiler of this type should be about ¼ in. for the outer wrapper and ⅜ in. thick for tube plates.*

It would be possible to fit about 50 tubes ¾ in. outside diameter by 16-gauge.

As to the material, copper is very expensive these days and, apart from the tubes, a mild steel boiler would be quite satisfactory so long as care is taken to use fairly pure feed-water. In addition, due care must be taken when laying it up for any length of time, to dry out the boiler completely, or, to fill it right up with water.

A ship modeller's diary

By JASON

THE most important job for secretaries of ship model societies this month is to make sure that their members have sufficient entry forms for the Model Engineer Exhibition (August 21 to 31). Remember, it is essential to include on the form the name of the society. Lone wolves should write direct to the exhibition manager for their entry forms.

There will, as usual, be a special stand for ship modellers, and Mr Gay will be glad of your help for a day or even half a day whether you are a member of an established society or not. As can be imagined there is plenty of help for evenings and weekends but there *are* vacancies during the mornings and afternoons. If, therefore, you can be of assistance, write to Mr Gay, 351 Kingshill Avenue, Hayes, Middlesex, specifying the days you will have available. The ship model societies' stand is the focal point for all ship modellers. See that it is well manned. Even the least experienced modeller can offer a welcome—and pick up a tip or two.

Round Pond rally

MAKE a note of the date of this year's rally—July 7—which is a Sunday. Maybe you've never seen half-a-dozen windjammers racing over the Pond? Maybe you have a model which will float or even sail? Then, why not have the satisfaction of seeing it afloat with other models?

Every year I've tried to entice people with sandwiches and a flask, but each year the rain has descended. Fortunately I am a Manxman, so my tail has not been between my legs. Write now for entry forms for any class of sailing model (except under M.Y.A. rules) to Mr Fisher, 19 The Grove, Greenford, Middlesex. In any case roll up. Where in the world will you see windjammers, barges, junks and galleons sailing? My! Some of those galleons can sail, too.

Merseyside matters

I RECENTLY visited the Liverpool Nautical Research Society. They meet on the ship *Landfall* in the Canning Dock—and believe me any modeller is made welcome. Naturally they delve into Merseyside matters particularly and, on the occasion of my visit, the P.R.O. of the Mersey Docks and Harbour Board was talking about the work—past and present—of keeping that great estuary clear for shipping. Comparisons with the Dee and Chester of several hundred years ago were inevitable; the channels are ever changing.

I was very surprised to learn that the veteran sand-dredger *Leviathan* is still afloat and working in spite of her 40 odd years of service. If I remember rightly she lifts 10,000 tons of sand in 50 min.

Those who know the Mersey, especially the upper reaches at Eastham and Runcorn, may often have wondered, as I did, why Big Business had not encroached upon the expansive mud-flats as extensions to their premises.

Mr Eric Sutton clearly knew his subject. The tidal waters scour out the channels, and, by carefully-aligned revetments and training walls, the Mersey Docks and Harbour Board utilise this immense power in this service of trade and commerce.

However, one mustn't forget the huge seaport of Manchester, for it pays a fair share of the enormous cost, as Mr Sutton pointed out.

The "Cutty Sark"

LAST month I made reference to a North London reader's query on the windlass fitted originally in *Cutty Sark*. As I expected, Mr Carr, the indefatigable director of the National Maritime Museum, wrote quite fully to the querist. Here is the gist of the matter. The original builders, Messrs Scott and Linton, went bankrupt, and Denny Brothers took over the work of completing the ship. The former had bitten off more than they could chew and naturally the latter firm were cautious, financially—hence the installation of the cheaper "common" windlass.

This is confirmed by *a* Sir Maurice Denny, *b* Mr David MacGregor who discovered the original drafts of the hull and fittings in the Glasgow Museum, *c* the testimony of several masters, including the last one, Captain Woodgett, who is still alive (Captain Woodgett served his time, was second mate and mate before becoming master of *Cutty Sark*), *d* the original ironwork marks were still visible on removal of the more modern Portuguese-fitted windlass, *e* a painting (by the marine artist Tudgan) dated 1872 shows clearly the pawl-bit and the fittings for the pump-handle windlass.

Let no one be in any doubt now about the windlass of *Cutty Sark*. I am indeed grateful to Mr Carr for his permission to quote from his letter so crammed with information.

Models in Liverpool

AS some readers may know, the Liverpool City Museum suffered heavy bombing during the war, the façade being the only remaining part left intact. Fortunately many of the more valuable contents had been moved to various places for safety. On my visit, however, I saw some French prisoner-of-war models of 160 years ago together with a few sailing ship models, probably under two score in all. Later I went down to a big store in Bootle where some of the staff were busy renovating some of the hundreds of models.

A builder's model of the *America*, a National Line steamer, caught my eye. She was built in the early Eighties and boasted both a turtle-back foc's'le head and a turtle-back poop. She was fiddle bowed and had some of the patent fancy anchors akin to the Trotman anchor. Her speed was 18 knots.

My guide was Mr Paget-Tomlinson who received part of his training at the National Maritime Museum. He told me he hopes to do for the Merchant Navy what Greenwich has done for the Royal Navy.

Liverpool has probably the finest collection of contemporary 18th century merchant ship models in the world, due in the main to the pioneer work of the late Robert Gladstone and Dr D. A. Allan, a former director of the Liverpool Museums. I'm happy to think that I was associated with these gentlemen.

Her Majesty's visit

ON Tuesday, June 25, the Queen will officially open the newly-restored *Cutty Sark*. Here is an ideal day's outing for modellers who visit London this year: sail from Westminster pier by river steamer to Greenwich and then if there is time, visit the National Maritime Museum. Indeed, a good modeller will make a three-day job of this.

Outdoor visits in London

VISITORS to London should write to Mr Fisher for the outdoor programme of the Thames Shiplovers and Ship Model Society. There is a varied and interesting programme, including "surprise" affairs. ▣

CLUB NEWS

EDITED BY THE CLUBMAN

M.E. DIARY

June 7.—Rochdale S.M.E., Lea Hall. North London S.M.E. "At Home," New Barnet, Herts, 8 p.m.

June 8.—Appleford Steam Traction Engine Rally, Bridge Farm, Appleford, first event 2 p.m. (open noon). Welling and District M.E.S. annual regatta, Belvedere Recreation Ground, Belvedere, Kent, 2 p.m. Birmingham S.M.E. track at Great Barr Horse Show.

June 9.—South London M.E.S. and Chingford and District M.E.C. annual joint locomotive trials, Ridgeway Park, Chingford, 11 a.m. Urmston and District M.E.S. official opening of season (June 9 and 10). West Riding S.L.S. visit to Workington Society, Blackgates, 8 a.m.

June 10.—North London S.M.E. loco section track meeting, Arkley, Barnet. Birmingham S.M.E. track at Shirley Carnival. Southend M.P.B.C. local regatta, 2.30 p.m. Bournville M.P.B.A. regatta. Cumberland Guild of Model Engineers and Craftsmen, official opening of new h.q.

June 11.—Bristol S.M.C. open discussion, Legion House, 7 p.m. (next season opens September 10).

STOP PRESS

I have just heard that the traction engine rally proposed for the great Hertfordshire Festival of Youth at Hatfield Park on Whit Saturday will not take place, largely because it would conflict with the Appleford Rally.

There will, however, be a display of veteran cars—some 120 of them, I am told—and also an exhibition illustrating the development of the automobile.

Queen Elizabeth the Queen Mother will attend as National Patron.

WITH the coming of June, model engineers throughout the world are once again giving nearly all their spare time to the service of good causes. Some of them have every week-end booked either at public events of their own or—what is more common—at events organised by other local groups.

Live steam at a garden fete delights the children and, in the course of providing them with pleasure, adds considerably to the takings for the day. The world outside the movement would be astonished to know (if all these sums could be totalled) how much money is raised for deserving aims by the model engineers—whose societies, alas, are not allowed the privileges granted to some other bodies under the Rating Act.

The operation of Section Eight is, however, decided by the central authorities. Most clubs exist on terms of mutual friendliness with their local administrators, and there are signs that this friendliness is increasing.

Realising that a model engineering club is an asset to the community—and not only because of its portable track, if it has one—the enlightened local council likes to give all the help that it can.

This week's news yields two encouraging examples.

COUNCIL PAYS

At Willesden the local council has financed the ambitious project undertaken by **Willesden and West London S.M.E.** to build a new continuous passenger-carrying track in Roundwood Park. Despite many setbacks the track has made remarkably rapid progress.

The club is fortunate in having a secretary with a thorough understanding of track work, and the inspiring readiness with which he has given of his time and talents, in designing, advising, and many other ways, earned him a unanimous vote of thanks at the eleventh annual meeting.

During a successful year marked by some major changes, the society (as reported here at the time) moved into a larger clubroom-workshop. Visitors will remember that the former headquarters suffered from lack of size. The more generous space means a very big step forward for the club and is, of course, especially useful for the track-building.

Despite the increased overheads, the club hopes to improve its facilities still further before much time has passed. With new plans well under way and several new locomotives coming forward to help the faithful *Ajax*, Willesden faces the future happily.

Anyone wishing to join this small, enthusiastic society is invited to communicate with secretary J. B. Cousins of 39 Caird Street, Paddington, London, W.10. Mr Cousins has been returned to office for a further period, together with chairman J. Dennison and treasurer G. Saggers.

STEAM IN NORWICH PARK

While **Norwich and District S.M.E.** has not been quite so fortunate as the Willesden club, the authorities are showing a positive interest in the society and are apparently doing their best for it.

The society wanted a site for a continuous track and the Corporation, in response, offered a good site in Eaton Park, one of the city's principal open spaces. Another request, for help in building a fence to surround the track, drew a blank from the city offices, presumably because of the economy campaign.

Apart from the natural understanding that the track would be used for model railway purposes, no conditions were attached by the council. Feeling that the offer was too good to refuse, the society (whose secretary is A. W. E. Hoskins of 5 Hellesdon Road, Norwich, Norfolk) lost no time in appointing a committee to draw up plans and specifications.

No doubt we shall hear of further progress soon; meanwhile the City of Norwich has gained another amenity.

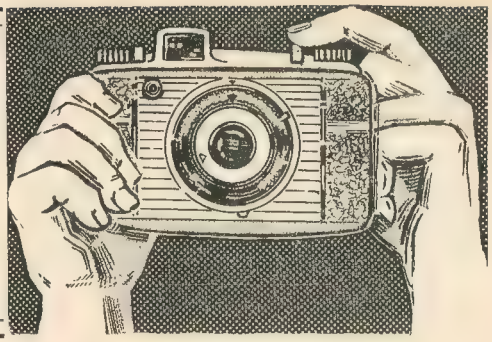
RALLY TRACK

One of the best multi-gauge tracks in the country, I am told, belongs to **Wolverhampton M.E.S.** Visiting clubs and unattached individuals are delighted with it.

During a year which was highly successful, in terms of general activities and of finance as well, the society acquired a portable track and a club locomotive, and was represented by its engines at various fetes and exhibitions.

Several of the members hail from Kidderminster and G. Austin at 229 Sutton Park Road in that town will be glad to hear from anyone in the district who may wish to join. Visits to the track at Wombourn—where the West Midlands Federation Rally is being held on June 15—are arranged by secretary B. F. Princep of 4 Princess Street, Wolverhampton.

M.E. PHOTOGRAPHIC COMPETITION



By THE EDITOR

THE success of the recent M.E. Competition prompted me to write in these columns that I would consider any other type which readers might suggest. One of the most popular ideas was that there should be a competition for photographs of models and I have pleasure in announcing details of such a competition today.

There are few rules. A first prize of £10, second of £5 and third of £3 are offered for the best photographs of models received by July 31. Perhaps I should make it plain that "models" means the model engineering type—any of the subjects, in fact, covered by MODEL ENGINEER. That gives wide scope, because model engineering itself has many facets—from model locomotives to clocks; from model sailing ships to the building of lathes; from model power boats to the repair of a broken crankshaft.

The only stipulation is that the main subject should be model engineering in some form or other. There are no restrictions on the background, foreground or ancilliary figures. Prints must be at least half-plate size (4½ in. × 6½ in.) and should not be larger than 10 in. × 8 in. They should be unmounted and will not be returned. They must be taken by the competitor but may be developed and printed commercially. Each photograph must have a completed entry form pasted on the back and coupons will be repeated each week until the closing date.

It is hoped that a display of the best photographs will be made at the Model Engineer Exhibition at the New Horticultural Hall, August 21-31. In addition to the prizes, 10s. 6d. will be paid for each photograph printed in MODEL ENGINEER. Send entries to Photographic Competition, Model Engineer, 19-20 Noel Street, London, W.1.

ENTRY FORM

(To be pasted on the back of each entry)

Name .....
(Block letters)

Address .....

.....

If member of a club, give its name.....

.....

I agree to the conditions and certify that I took the picture submitted.

Signed.....

DETAILS OF PHOTOGRAPH

Title.....

Builder of model(s) in picture:

Name.....

Address.....

.....

Further details of model(s).....

.....

.....

Camera..... Exposure..... Stop.....

Film or plate..... Lighting.....

Any other information .....

.....

.....

CONDITIONS OF ENTRY

1. The photographs submitted shall be of any form of model engineering and must be taken by the competitor but may be developed commercially. Prints should be unmounted, not more than 10 in. x 8 in. and no less than half-plate (4½ in. x 6½ in.).
2. Competitors may send more than one photograph but each must have a coupon from Model Engineer firmly pasted on the back. Coupons will be published each week until the closing date.
3. The closing date will be July 31. Entries to be sent to: Photographic Competition, Model Engineer, 19-20 Noel Street, London, W.1.
4. A first prize of £10 will be provided, with second prize of £5 and third of £3. In addition, 10s. 6d. will be paid for each other photograph published in Model Engineer.
5. Prints will not be returned and the Editor reserves the right to publish any of them in Model Engineer.
6. Copyright of photographs sent must rest with the competitor.
7. The decision of the Editor shall be final in any question affecting the competition.

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19/20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Black and Decker, Wolf accessories, second-hand, sold separately. S.A.E. list —DENNY, 64, William Street, Long Eaton, Nottingham.

Home-Master Workshop. All-in-one units, £14 10s. or £2 10s. deposit and 8 monthly payments of £1 15s. Will be sent carriage paid on receipt of deposit. (Money back guarantee if machine is returned within 7 days.) Write for/send orders to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, W. 4. Telephone No. Chiswick 3416. Free 36-page booklet on application.

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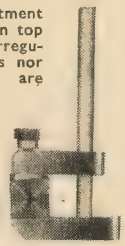

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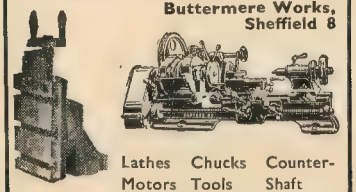

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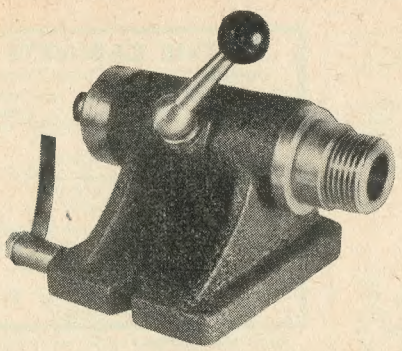

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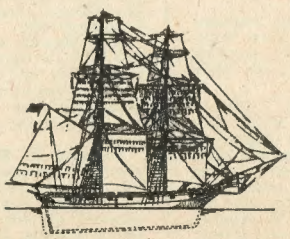

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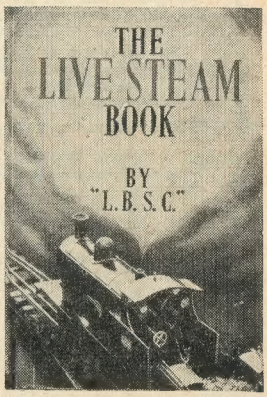

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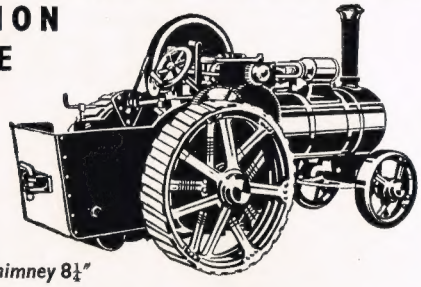

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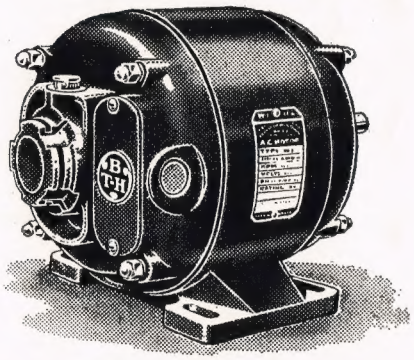

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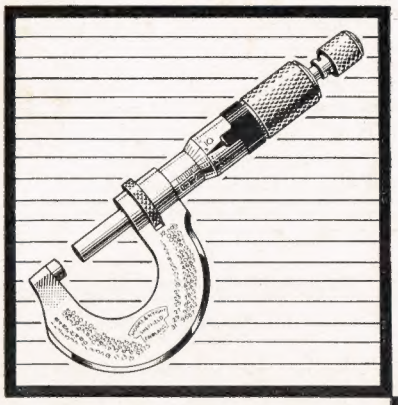

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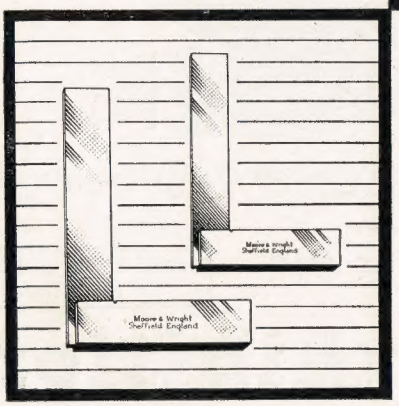

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